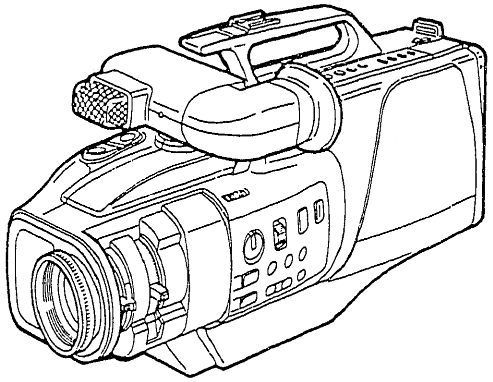
HITACHI

SERVICE MANUAL

TK | **No.3517E**

VM-4400A(U,C)
VM-4450AW,A(PX)

Technical Data



MANUAL RELATED TO THE VM-4400A, VM-4450A

TITLE	MODEL	MANUAL No.
Technical Informatin	VM-4400A	No. 3518E
RF UNIT	VM-RF71A	No. 2996E
POWER ADAPTER /CHARGER	VM-AC66A /VM-AC67A	No. 3598E

Supplement - TK No.3616E,F GO

Supplement II - TK No. 3656E GO

SPECIFICATIONS

■ **General**	
Power requirements	9.6V DC
Power consumption	8 watts (nominal)
Dimensions	5-3/8"(W) x 7-11/16"(H) x 15-5/16"(D) 136(W) x 195(H) x 389(D) mm
Weight	4.9 lbs (2.2 kg)
■ **Video Recorder Section**	
Format	VHS
Record/playback system	Two video record/playback heads plus a flying erase head
Video signal	EIA standard NTSC color
Tape speed	33.35 mm/sec.
Video input	1.0 Vp-p, 75 ohm
Video output	1.0 Vp-p, 75 ohm
Audio input	−7.8 dBs (316 m Vrms), more than 47K ohms
Audio output	−7.8 dBs (316 m Vrms), less than 1K ohm
Fast forward/rewind time	Less than 10 minutes with T-160 cassette
■ **Camera Section**	
Scanning	525 lines/60 fields/30 frames
Required minumum illumination	2 lux
Pickup device	1/3" C.C.D.
Lens diameter	46 mm

VHS

This video deck is a VHS type video recorder. For proper operation, only the VHS type cassette must be used.

SAFETY PRECAUTIONS

The following precautions should be observed when servicing.

1. Since many parts in the unit have special safety-related characteristics, always use genuine Hitachi replacement parts. Especially critical parts in the power circuit block should not be replaced with other makers'. Critical parts are marked with ⚠ in the schematic diagram.
2. Before returning a repaired unit to the customer, the service technician must thoroughly test the unit to ascertain that it is completely safety operate without danger of electrical shock.

X-RAY RADIATION

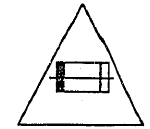
The primary source or X-ray radiation in this viewfinder is the picture tube. The tube used in this view-finder is especially constructed to limit X-ray radiation emission. For continued X-ray radiation protection, the replacement tube must be the same type as the original, Hitachi approved one.

SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

VIDEO CASSETTE RECORDER

August **1991** TOKAI WORKS

CAUTION AGAINST FUSE REPLACEMENT



CAUTION : FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH SAME TYPE AMPERE, VOLT FUSE.

ATTENTION : AFIN D'ASSURER UNE PROTECTION PERMANENTE CONTRE LES RISQUES D'INCENDIE, REMPLACER UNIQUEMENT PAR UN FUSIBLE DE MEME TYPE ET DE AMPERES VOLTS.

This symbol indicates Fast Operating Type Fuse.

CONTENTS

CHAPTER 1

IDENTIFICATION AND OPERATION OF CONTROLS ... 1-1

CHAPTER 2 DISASSEMBLY

1. INSTRUMENT DISASSEMBLY
1-1. Left Case 2-1
1-2. Front Cover 2-1
1-3. Electronic Viewfinder (EVF) 2-1
1-4. Carrying Handle 2-1
1-5. Accessory Shoe 2-1
1-6. DC Light Circuit Board 2-2
1-7. Cassette Lid 2-2
1-8. Right Case Removal 2-2
1-9. Tele./Wide Switch 2-2
1-10. Main Circuit Board and Tape Transport Mechanism 2-3
1-11. Control Circuit Board 2-3
1-12. Process Circuit Board 2-3
1-13. Sensor Circuit Board 2-4
2. LENS BLOCK DISASSEMBLY
2-1. Auto Focus Circuit Board 2-4
2-2. Lens Block 2-5
2-3. Focus Motor 2-5
2-4. Zoom Motor 2-5
2-5. Iris Block 2-5
3. ELECTRONIC VIEWFINDER (EVF) DISASSEMBLY
3-1. Top Case 2-5
3-2. Electronic Viewfinder (EVF) Circuit Board 2-6
3-3. Mic Assembly 2-6
3-4. CRT 2-6
4. TAPE TRANSPORT MECHANISM DISASSEMBLY
TAPE TRANSPORT MECHANISM - TOP VIEW 2-7
TAPE TRANSPORT MECHANISM - BOTTOM VIEW ... 2-7
4-1. Cassette Holder Release 2-8
4-2. Cassette Holder 2-8
4-3. Cassette Holder Bracket 2-8
4-4. Full Erase Head, Supply End Sensor and Cleaning Assembly (Dew Sensor) 2-9
4-5. Upper Cylinder (Video Head) 2-9
4-6. Lower Cylinder (Cylinder Motor Assembly) 2-10
4-7. Audio/Control (A/C) Head and Audio/Control (A/C) Head Arm 2-10
4-8. Impedance Roller 2-10
4-9. Supply Guide Roller 2-10
4-10. Take-up Guide Roller 2-11
4-11. Tension Arm, Tension Band, Tension Band Arm and Tension Band Release Arm 2-11
4-12. Cassette Holder Lock 2-11
4-13. Reel Block Cover 2-12
4-14. Supply and Take-up Reel Tables 2-12
4-15. Supply Sub Brake 2-12
4-16. Take-up Sensor Circuit Board 2-12
4-17. Cassette Holder Damper 2-12
4-18. Reel Gear Block 2-13
4-19. Mechanical State Switch 2-13
4-20. Circuit Board Holder (2) 2-14
4-21. Loading Gear Block and Cam Arm 2-14
4-22. Impedance Pulley 2-14
4-23. Static Discharge Brush 2-14
4-24. Compression Plate and Take-up Tension Arm 2-15
4-25. Supply Slant Pole 2-15
4-26. Loading Guide Plate (2) and Loading Guide Plate (3) 2-15
4-27. Lock Gear 2-15
4-28. Loading Guide Plate (5) 2-15
4-29. Loading Guide Plate (6) 2-15
4-30. Cylinder Base 2-15
4-31. Pressure Roller Assembly, Take-up Guide Roller and Loading link 2-17
4-32. Guide Pole Arm 2-17
4-33. Gear (1), Gear (2) and Gear (3) 2-17
4-34. Corner Roller Assembly 2-18
4-35. Loading Guide Plate (4) 2-18
4-36. Capstan Motor 2-18
4-37. Take-up Guide Pole Stopper 2-18
4-38. Pressure Roller Compression Link 2-19
4-39. Loading Ring Assembly 2-19

JIG AND TAPES FOR ADJUSTMENT 3-1

CHAPTER 3 MECHANICAL ADJUSTMENT

1. BEFORE STARTING ADJUSTMENT 3-2
2. CAM ARM AND TENSION BAND ARM OPERATION ARM POSITION SET 3-2
3. PHASE MATCHING IN ASSEMBLY 3-2
4. TAPE TRANSPORT SYSTEM CHECK /ADJUSTMENT 3-3
4-1. Reel Disk Height Adjustment 3-3
4-2. Tension Arm Position Adjustment 3-4
4-3. Tension Adjustment 3-4
4-4. Supply Guide Pole Height Adjustment 3-5
4-5. Take-up Guide Pole Stopper Height Adjustment 3-5
4-6. Supply and Take-up Guide Rollers 3-5
4-7. Audio/Control Head Adjustment 3-6
4-8. Adjustment After Replacing the Cylinder 3-7
5. CHECK THE TORQUES 3-7

CHAPTER 4 ELECTRICAL ADJUSTMENT

1. CONNECTIONS FOR ADJUSTMENT 4-1
2. CAMERA SECTION ADJUSTMENT 4-1
2-1. CIRCUIT BOARD LOCATIONS 4-1
2-2. TEST EQUIPMENT AND CHARTS NECESSARY FOR 4-1
2-3. ADJUSTMENT CONDITIONS 4-1
2-4. PRESET POSITION OF SWITCHES AND CONTROLS 4-1
2-5. LIST OF CHARTS FOR CAMERA ADJUSTMENT 4-2
2-6. CAMERA ADJUSTMENT 4-3
1) Subcarrier Frequency Confirmation 4-3
2) Sensor Drive Pulse Frequency Confirmation 4-3
3) Backfocus Adjustment 4-3
4) Sensor Sub Voltage Adjustment 4-3
5) Preset Digital Signal Processing (DSP) Adjustment 4-4
6) Auto Iris Control Level Adjustment ... 4-6
7) Iris Calibration Adjustment 4-6
8) Blue Matrix Adjustment 4-7
9) White Balance Adjustment 4-8
10) Chroma Gain Adjustment 4-9

2-7. ELECTRONIC VIEWFINDER (EVF) ADJUSTMENT 4-10
1) EVF Focus Adjustment 4-10
2) Deflection Yoke Position Adjustment 4-10
3) EVF Centering Adjustment 4-10
4) EVF Vertical Size Adjustment 4-10
5) EVF Brightness Adjustment 4-10
2-8. AUTO FOCUS ADJUSTMENT 4-11
1) AUTO FOCUS Sensor Position Adjustment 4-11
2-9. ADJUSTMENT WHICH CAN BE DONE USING A VECTORSCOPE 4-11
2-10. ADJUSTMENT COMPONENTS LOCATIONS 4-12
3. VCR SECTION ADJUSTMENT 4-12
3-1. CIRCUIT BOARD LOCATIONS 4-12
3-2. TEST EQUIPMENT AND ALIGNMENT TAPES NECESSARY 4-12
3-3. ADJUSTMENT CONDITIONS 4-12
3-4. PRESET POSITION OF SWITCHES AND CONTROLS DURING ADJUSTMENT 4-12
3-5. SERVO SECTION 4-13
1) Head Switching Point Adjustment 4-13
3-6. LUMA/CHROMA SECTION 4-13
1) Record Chroma and Luminance Level Adjustment 4-13
2) 1H Delay Line Output Level Adjustment 4-14
3-7. AUDIO SECTION 4-14
1) Audio bias Level Adjustment 4-14
3-8. ADJUSTMENT COMPONENTS LOCATIONS 4-14

CHAPTER 5 SCHEMATIC DIAGRAM AND CIRCUIT BOARD DIAGRAMS

WHEN USING THIS SERVICE REFERENCE MATERIAL 5-1
LEADLESS COMPONENT IDENTIFICATION 5-2
INTERNAL WIRING DIAGRAM 5-5

	SCHEMATIC DIAGRAM		CIRCUIT BOARD
SENSOR	5-7	/	5-9
CONTROL	5-10	/	5-9
PROCESS - PROCESS	5-11	/	5-15
DIGITAL - PROCESS	5-13	/	5-15
ELECTRONIC VIEWFINDER (EVF)	5-19	/	5-19
TROUBLE SENSOR - MAIN	5-20	/	5-35
AUDIO - MAIN	5-21	/	5-35
SWITCHING REGULATOR - MAIN	5-23	/	5-35
SWR CONTROL	5-24	/	5-40
SYSTEM CONTROL	5-25	/	5-35
CYL. MOTOR DRIVE - MAIN	5-28	/	5-35
CAPSTAN MOTOR	5-28	/	----
SERVO - MAIN	5-29	/	5-35
PRE AMP - MAIN	5-31	/	5-35
LUMINANCE/CHROMA - MAIN	5-33	/	5-35
VM-4450A			
SYSTEM CONTROL - MAIN	5-43	/	5-45
IR RECEIVER	5-47	/	5-47

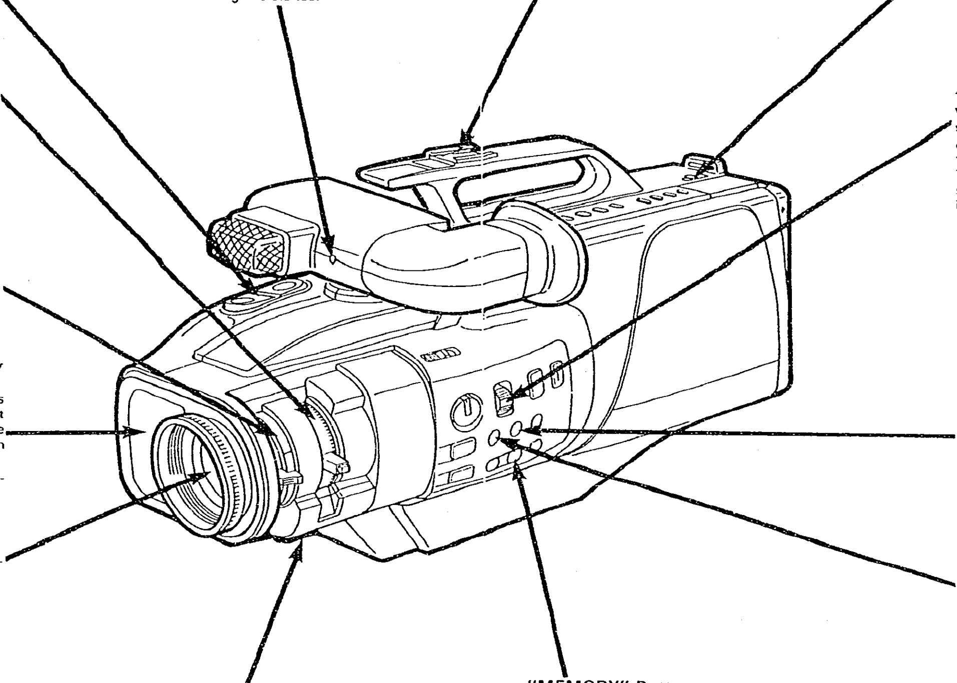
WAVEFORMS

SENSOR 5-8
PROCESS 5-16
ELECTRONIC VIEWFINDER EVF) 5-19
SERVO 5-27
LUMINANCE/CHROMA 5-32

CHAPTER 6 EXPLODED VIEW

CABINET SECTION 6-1
CHASSIS (UPPER) SECTION 6-2
CHASSIS (LOWER) SECTION 6-3
ELECTRONIC VIEWFINDER (EVF) SECTION 6-4
LENS SECTION 6-5
LUBRICATION 6-3
CHAPTER 7 REPLACEMENT PARTS LIST 7-1

CHAPTER 1 IDENTIFICATION AND OPERATION OF CONTROLS



Power Zoom Switch
This switch performs zooming electrically.

"W": Picture becomes wider gradually.
"T": Picture becomes telescopic gradually.

Record Indicator
This indicator lights up to indicate that the camera/recorder is recording. During self timer operation, this light flashes to indicate recording is about to begin then stays on to indicate recording has started.

Accessory Shoe
Used to attach the DC camera light

"BATTERY" Release Lever
Releases the battery attached to the video camera/recorder.

Zoom Ring (Manual Zooming)
The picture size can be magnified 8 times with the use of the zoom feature. Just rotate the zoom ring for a close up (T) or wide angle (W) picture. Macro close-up, as close as 1 cm from object, is feasible.

"FULL AUTO" Switch
When this switch is set to "AUTO", the focus, shutter speed and iris are adjusted automatically. Also NEG/POS operation is set to "POS" automatically.
To adjust these functions manually, set this switch to "MAN" and adjust the corresponding buttons and switches.

Focus Ring
Used to achieve manual focus.
Do not attempt to manually turn the focus ring when the camera/recorder is in the auto focus mode.

Auto Focus Window/Infrared Ray Receiver (VM-4450A)
To automatically focus the camera lens, this window transmits and receives infrared light which is reflected off the object. Make sure you don't obstruct this window when recording.
The window also receives infrared rays from remote control unit (provided). (VM-4450A)

"DISPLAY" Button
Pressing this button once causes a 5 digit linear time counter and battery indicator to appear in the camera/recorder's viewfinder. Pressing the button again will cause battery indicator and the amount of time remaining on the cassette in the camera/recorder.
Press a 3rd time to delete all displays.

Lens
F1.4 (6.2 ~ 50 mm) 8:1 power zoom lens features auto focus and auto iris functions.

"SHUTTER" Button
Used to control the shutter speed during recording and/or record/pause (stand-by) mode.

"MEMORY" Button
If this button is pressed while the linear time counter or time remaining read-out is displayed in the viewfinder, "M" appears in the display and it memorizes the tape position of "0:00:00"

"PUSH AUTO" Focus Button
Auto focusing can be also performed during manual focus mode by pushing this button.

Cover for DC camera Light Terminal

When the DC camera light is attached to the accessory shoe, this cover slides and power can be supplied to the DC camera light.
Caution: To help avoid any potential hazard from electric shock, do not open this cover when the DC camera light is not attached and the camera/recorder is turned on.

Electronic Viewfinder (EVF)

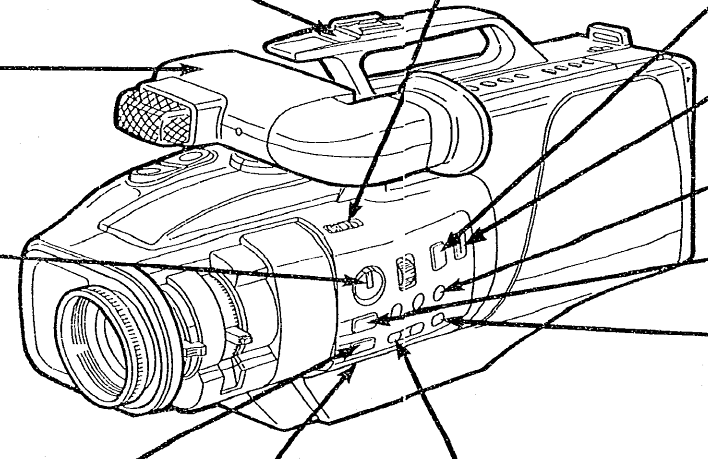
Displays what the camera/recorder lens sees. The electronic viewfinder also functions as a convenient black-and-white monitor during playback of recorded material.
NOTE: The electronic viewfinder must be in the operting position before the camera/recorder will record.

"IRIS" Control

With this control in the center click position or "FULL AUTO" switch is set to "AUTO", the camera/recorder automatically adjusts the lens opening for the best picture in normal conditions.
The auto iris system can also be adjusted to compensate for unusual lighting. When the subject is in bright light and the background is dark, set "FULL AUTO" switch to "MAN" and turn this control counterclockwise to close the lens iris opening. When the background is in bright light and the subject appears too dark, turn the control clockwise to open the lens iris.

"FADE" Button

During recording you can add a professional touch to your recordings by fading in and out of scenes.
NOTE: When you use "FADE" button to fade in and out, the sound will also fade in and out with the picture.



"TIME LAPSE/SELF TIMER" Switch

This switch allows time lapse, one shot and self timer recording.

"NEG/POS" Switch

- Normally set to "POS".
- Set to "NEG" for special effects as in a negative film.

NOTE: When "FULL AUTO" switch is set to "AUTO", "NEG/POS" operation is set to "POS" automatically.

"RESET/T-160/T-180" Button

When the linear time counter is displayed in the viewfinder, pressing this button resets the counter to "0:00:00".
When the time-remaining read-out is displayed, pressing this button changes the display for extended length T-160 or T-180 tape. "T-160" or "T-180" will appear in the viewfinder.

"TITLE" Button

Press this button to create and record personalized titles on your videos with the camera/recorder's built-in titler.

"ZOOM MODE" Button

Use this button to switch the digital zoom feature. Usually press this button so that "ZM:1" appears in the viewfinder.

"DATE/TIME" Button

Press this button to display the date and time in the viewfinder.
Whenever the date and time appear in the viewfinder, they will be recorded on the tape.

"REVIEW" Button

Used to review the last few seconds of the recorded segment in the record/pause mode.

"INDEX" Button

When this button is pressed during a recording, the camera/recorder records an invisible index mark on the tape.
This is useful later when the tape is played back in your camera/recorder or a VCR that features the indexing system called "VHS Index Search System" because you will be able to quickly locate each index mark.

"POWER" Switch

This switch changes the camera/recorder to the record mode or to the playback mode.
Press and hold the small button on this switch, and then slide it to "CAM", "OFF" or "VCR".
The electronic viewfinder must be in the operating position before the camera/recorder will record.

"POWER"/Dew Indicator Light

Flashing of the light indicates dew condensation on camera/recorder mechanism. While this light is flashing, the unit will not operate. If this occurs, eject the tape and leave the power on. When the light stops flashing, the unit can be operated.

"REW" Button

Press this button during stop or fast forward mode, and fast-rewinding starts. "REWIND" indication appears in the viewfinder whenever the tape counter or time remaining is present.
Press the button during playback of tape, and the tape is played back in the rewind direction approximately 3 times faster than the normal speed to confirm the recorded contents.
Press "PLAY" button to return to normal playback mode or press "STOP" button to stop tape movement.
NOTE: You can also visually scan backward when the camera/recorder is in the record/pause (stand-by) mode by pressing and holding this button.

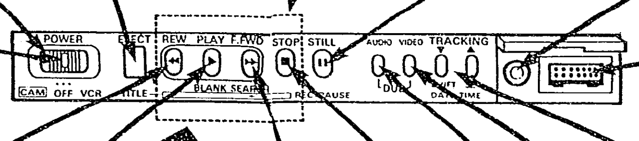
"PLAY" Button

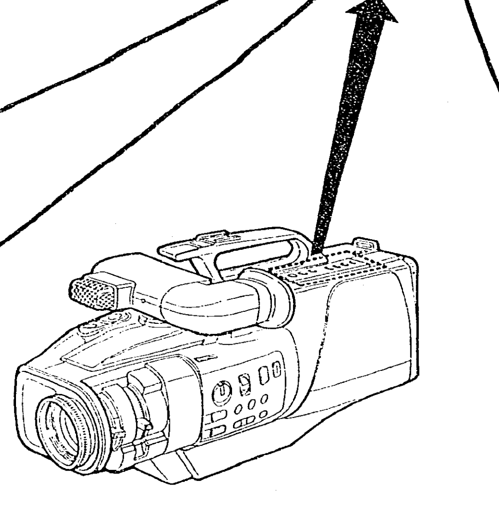
Used for playback of tape recorded in the SP mode.
NOTE: When the camera/recorder is in the record/pause (stand-by) mode, pressing and holding this button will play the tape at normal speed.

"EJECT" Button

Operates with "POWER" either on or off, if a power source is connected to the camera/recorder.

These buttons are used for title making buttons when the "TITLE" button is pressed.





"F.FWD" Button

Press this button during stop or rewind mode, and fast-forwarding starts. "FAST FWD" indication appears in the viewfinder whenever the tape counter or time remaining is present.
Press the button during playback of tape, and the tape is played back in the forward direction approximately 3 times faster than the normal speed to confirm the recorded content.
Press "PLAY" button to return to normal playback mode or press "STOP" button to stop tape movement.
NOTE: You can also visually scan forward when the camera/recorder is in the record/pause (stand-by) mode by pressing and holding this button.

"STILL (REC/PAUSE)" Button

When this button is pressed during recording, the tape stops and the camera/recorder enters the record/pause (stand-by) mode. When this button is pressed again, the tape begins recording. This button may be also used to display a still picture during playback mode.

"EAR"phone Jack

Sound being recorded by the microphone or played back may be monitored by attaching earphone (Not supplied) to this jack.

"AV OUT" Jack

Connect the video/audio output cord (Accessory No. 1) to this jack and to the audio and video inputs of your TV/monitor receiver. You may also connect the RF converter unit to this jack and your TV receiver.

"TRACKING" Buttons

Used when playing a tape recorded on another VCR. Adjust for best picture. Ejecting the cassette returns the tracking to the normal position. These Buttons may be also used to set the date and clock during pause (stand-by) mode.

"VIDEO DUB" Button

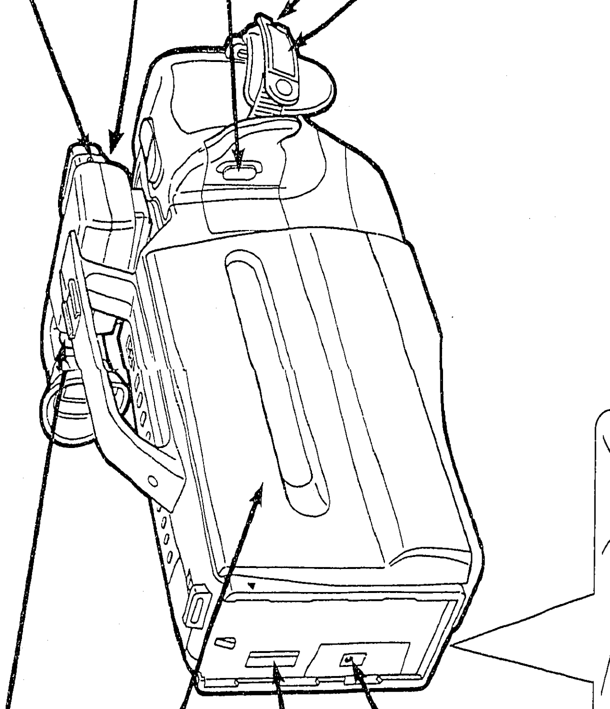
This button is used to record new video in place of existing video without erasing the audio.

"AUDIO DUB" Button

This button is used to record new audio in place of existing audio without erasing the video.

"STOP" Button

The "STOP" button is used to stop playback, rewind, and fast forward operations. The "STOP" button has no effect during record operation.



Diopter Control
To use the electronic viewfinder without eyeglasses on, turn this control knob for your optimum focus adjustment.

Cassette Holder
Press "EJECT" button to open the cassette holder. Be aware of the cassette direction when inserting.
NOTE: Power source must be connected to open the cassette holder.

Clock Battery Compartment
Pull the battery holder and install the clock battery (provided).

"DC IN 9.6V" Jack
When using the AC adaptor/charger (Accessory No. 3) or car battery cord (optional), connect this jack and the "DC OUTPUT" of the AC adaptor/charger or the car's cigarette lighter socket.

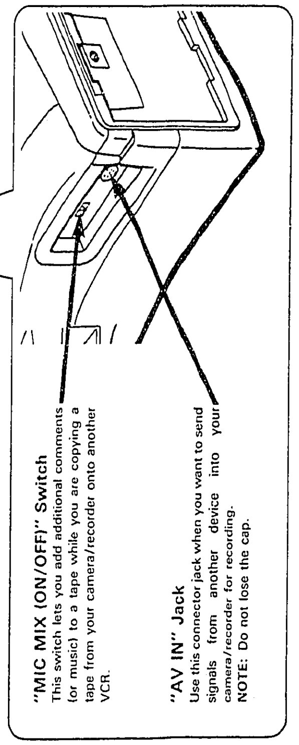
"MIC" Jack
Connect an external microphone (Not supplied) here to record sound from the external microphone.
NOTE: Connecting an external microphone automatically switches off the built-in microphone.

"MIC WIND/NORM" Switch
This switch is used to reduce noise that occurs due to wind. Place the switch in the NORMAL position for normal use.

Record Start/Stop Button
This button is used to control the camera/recorder. When "POWER" switch is set to "CAM" position, pressing this button starts the tape to begin recording. "REC" appears in the viewfinder.
When this button is pressed again, "PAUSE" appears instead of "REC" and the tape stops and the camera/recorder enters the record/pause (stand-by) mode.

Lens Cap Tab
Place the lens cap on this tab when you are ready to record a scene. The tab also prevents the lens cap from swinging around on its cord.

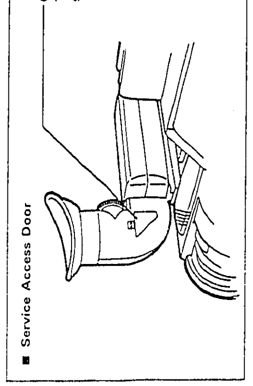
Hand Strap
Adjust to best fit to your hand.



"MIC MIX (ON/OFF)" Switch
This switch lets you add additional comments (or music) to a tape while you are copying a tape from your camera/recorder onto another VCR.

"AV IN" Jack
Use this connector jack when you want to send signals from another device into your camera/recorder for recording.
NOTE: Do not lose the cap.

- **Service Access Door**



Open to clean picture tube face, mirror and lens. To prevent scratching, use a soft non abrasive cloth, swab or lens cleaning paper.

CHAPTER 2 DISASSEMBLY

1. INSTRUMENT DISASSEMBLY

1-1. Left Case

1) Move the EVF in the direction of arrow (A). (See Fig. 2-1)
2) Turn the EVF neck in the direction of arrow (B).
3) Remove eleven (11) screws holding the left case.
4) Open the left case in the direction of arrow (C).

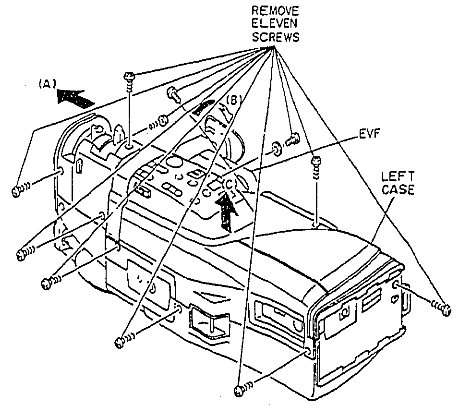


Fig. 2-1

1-2. Front Cover

ORDER FOR REMOVING PARTS	*ITEM No.*
·Left Case.	1-1

1) Turn the lens food counter clockwise to remove it. (See Fig. 2-2)
2) Remove two (2) screws holding the front cover.

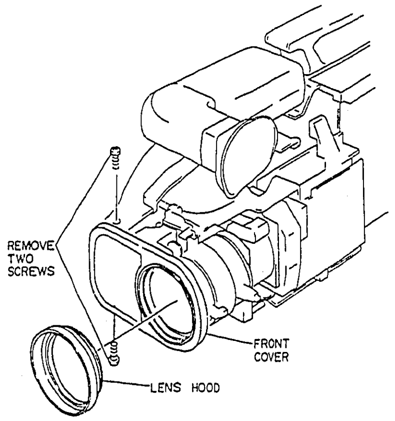


Fig. 2-2

1-3. Electronic Viewfinder (EVF)

ORDER FOR REMOVING PARTS	*ITEM No.*
·Left Case.	1-1

1) Disconnect three (3) connectors (CN908, CN909, CN401) on the main circuit board. (See Fig. 2-3)
2) Remove one (1) screw holding the EVF shoe and remove the EVF in the direction of the arrow.

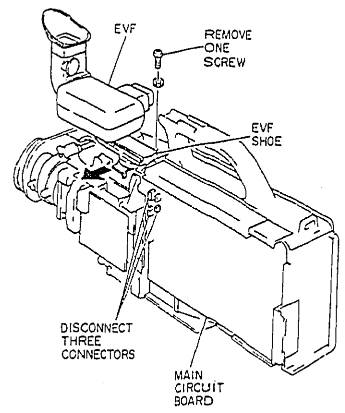


Fig. 2-3

1-4. Carrying Handle

ORDER FOR REMOVING PARTS	*ITEM No.*
·Left Case	1-1

1) Disconnect connector CN906 on the main circuit board. (See Fig. 2-4)
2) Remove one (1) screw holding the carrying handle.
3) Remove the carrying handle in the direction of the arrow.

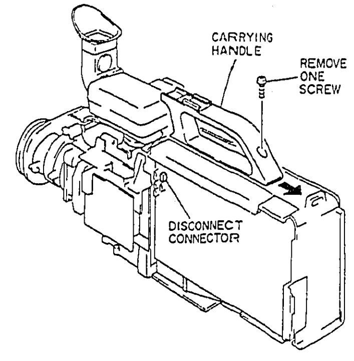


Fig. 2-4

1-5. Accessory Shoe

1) Remove one (1) screw holding the accessory shoe spring. (See Fig. 2-5)
2) Remove the accessory shoe spring in the direction of the arrow.
3) Remove two (2) screws holding the accessory shoe.

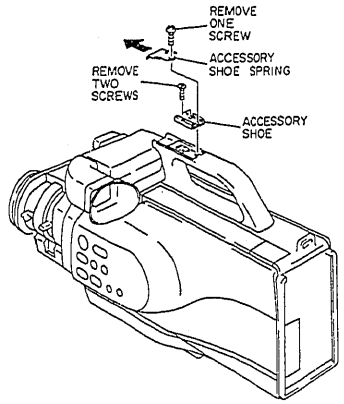

REMOVE
ONE
SCREW
REMOVE
TWO
SCREWS
ACCESSORY
SHOE SPRING
ACCESSORY
SHOE

Fig. 2-5

1-6. DC Light Circuit Board

ORDER FOR REMOVING PARTS	ITEM No.
·Carrying Handle	1-4
·Accessory Shoe	1-5

1) Remove one (1) screw holding the DC light circuit board. (See Fig. 2-6)
2) Remove the handle front cover in the direction of arrow (A).
3) Remove the slide cover in the direction of arrow (B).

Note: When it is installed, pass the connector from the DC light circuit board through the carrying handle first, then install the handle front cover.

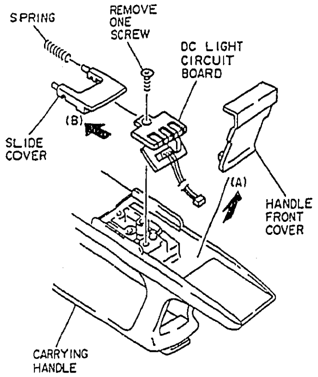

SPRING
REMOVE
ONE
SCREW
DC LIGHT
CIRCUIT
BOARD
(B)
SLIDE
COVER
(A)
HANDLE
FRONT
COVER
CARRYING
HANDLE

Fig. 2-6

1-7. Cassette Lid

1) Press "EJECT" button to open the cassette lid.
2) Remove two (2) screws holding the cassette lid. (See Fig. 2-7)
3) Remove the cassette lid in the direction of the arrow.

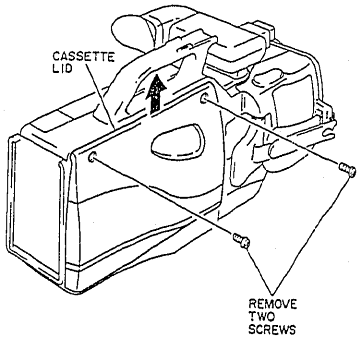

CASSETTE
LID
REMOVE
TWO
SCREWS

Fig. 2-7

1-8. Right Case Removal

ORDER FOR REMOVING PARTS	ITEM No.
·Left Case	1-1
·Front Cover	1-2
·Electronic Viewfinder (EVF)	1-3
·Cassette Lid	1-7

1) Remove the clock battery holder using a coin etc. (See Fig. 2-8)
2) Disconnect two (2) connectors (CN907, CN906) on the main circuit board.
3) Disconnect CN103 from the process circuit board, located under the control circuit board.
4) Remove four (4) screws holding the right case.
5) Pull the right case in the direction of arrow (A), and while releasing one (1) tab, remove the right case in the direction of arrow (B).

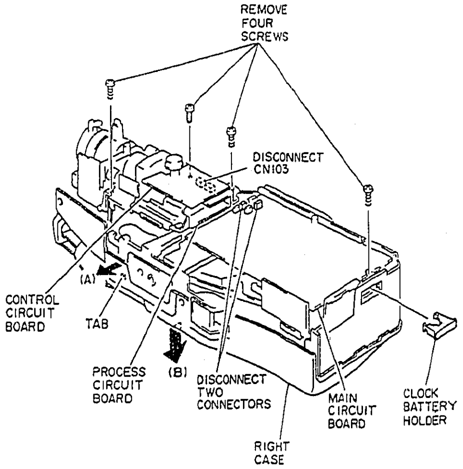

REMOVE
FOUR
SCREWS
DISCONNECT
CN103
(A)
CONTROL
CIRCUIT
BOARD
TAB
PROCESS
CIRCUIT
BOARD
(B)
DISCONNECT
TWO
CONNECTORS
MAIN
CIRCUIT
BOARD
CLOCK
BATTERY
HOLDER
RIGHT
CASE

Fig. 2-8

1-9. Tele./Wide Switch

ORDER FOR REMOVING PARTS	ITEM No.
·Left Case	1-1
·Front Cover	1-2
·Electronic Viewfinder (EVF)	1-3
·Cassette Lid	1-7
·Right Case	1-8

1) Release three (3) tabs and remove the direction of the arrow. (See Fig. 2-9)

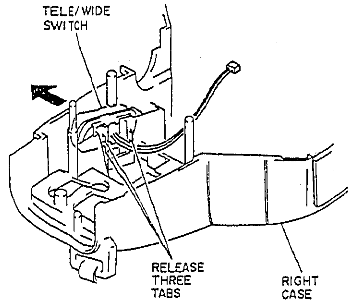

TELE/WIDE
SWITCH
RELEASE
THREE
TABS
RIGHT
CASE

Fig. 2-9

1-10. Main Circuit Board and Tape Transport Mechanism

ORDER FOR REMOVING PARTS	ITEM No.
·Left Case	1-1
·Front Cover	1-2
·Electronic Viewfinder (EVF)	1-3
·Cassette Lid	1-7
·Right Case	1-8

For VM-4400A

1) Disconnect five (5) connectors (CN402, CN403, CN602, CN905, CN911). (See Fig. 2-10a)

For VM-4450A

1) Disconnect six (6) connectors (CN402, CN403, CN602, CN905, CN911, CN912). (See Fig. 2-10a)
2) Disconnect four (4) flat cables (CN904, CN201, CN601, CN903).
3) Remove two (2) screw holding the shield cover. (See Fig. 2-10b)
4) Release three (3) tabs and open the main circuit board in the direction of the arrow. (See Fig. 2-10a)

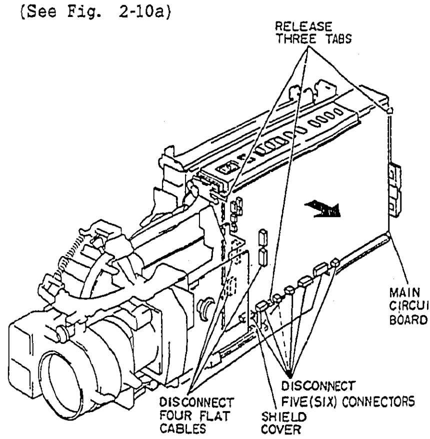

RELEASE
THREE TABS
MAIN
CIRCUIT
BOARD
DISCONNECT
FIVE(SIX) CONNECTORS
DISCONNECT
FOUR FLAT
CABLES
SHIELD
COVER

Fig. 2-10a

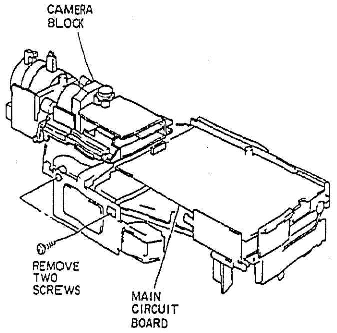

CAMERA
BLOCK
REMOVE
TWO
SCREWS
MAIN
CIRCUIT
BOARD

Fig. 2-10b

1-11. Control Circuit Board

ORDER FOR REMOVING PARTS	ITEM No.
·Left Case	1-1

1) Disconnect connector CN106. (See Fig. 2-11)
2) Release two (2) tabs holding the control circuit board.
3) Pull the control circuit board out to remove

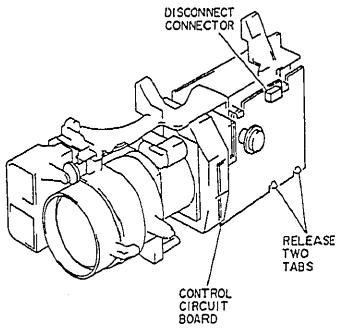

DISCONNECT
CONNECTOR
RELEASE
TWO
TABS
CONTROL
CIRCUIT
BOARD

Fig. 2-11

1-12. Process Circuit Board

ORDER FOR REMOVING PARTS	ITEM No.
·Left Case	1-1
·Front Cover	1-2
·Electronic Viewfinder (EVF)	1-3
·Cassette Lid	1-7
·Right Case	1-8

For VM-4400A

1) Disconnect flat cable CN904. (See Fig. 2-12)

For VM-4450A

1) Disconnect flat cable CN904 and connector CN912. (See Fig. 2-12)
2) Remove one (1) screw holding the camera block.
3) Release two (2) tabs holding the process circuit board. (See Fig. 2-13)
4) Move the process circuit board in the direction of arrow (A) to disconnect CN101 and then move the board in the direction of arrow (B) to remove it.
5) Disconnect three (3) connectors (CN106, CN104, CN105).

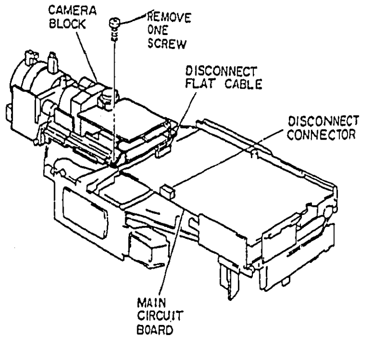

CAMERA
BLOCK
REMOVE
ONE
SCREW
DISCONNECT
FLAT CABLE
DISCONNECT
CONNECTOR
MAIN
CIRCUIT
BOARD

Fig. 2-12

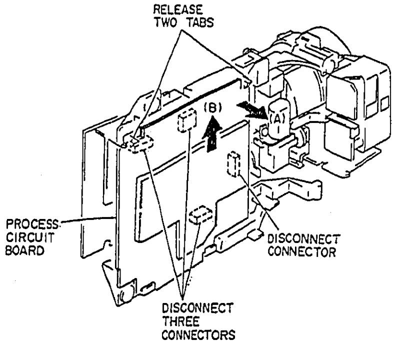

RELEASE TWO TABS
(B)
(A)
PROCESS CIRCUIT BOARD
DISCONNECT CONNECTOR
DISCONNECT THREE CONNECTORS

Fig. 2-13

1-13. Sensor Circuit Board

ORDER FOR REMOVING PARTS	ITEM No.
·Left Case	1-1
·Front Cover	1-2
·Electronic Viewfinder (EVF)	1-3
·Cassette Lid	1-7
·Right Case	1-8
·Process Circuit Board	1-12

1) Remove three (3) screws holding the lens frame. (See Fig. 2-14)
2) Remove the lens block in the direction of the arrow .
3) Remove the shield cover. (See Fig. 2-15)
4) Remove the IC003 in the direction of the arrow.
5) Remove one (1) screw holding the sensor shield.
6) Remove the sensor shield in the direction of the arrow.
7) Remove two (2) screws holding the sensor circuit board. (See Fig. 2-16)
8) Pull the sensor circuit board in the direction of the arrow.

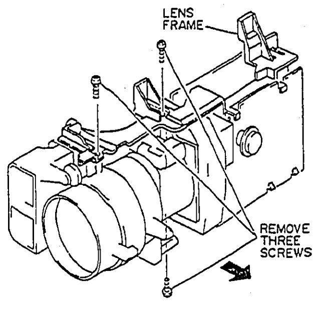

LENS FRAME
REMOVE THREE SCREWS

Fig. 2-14

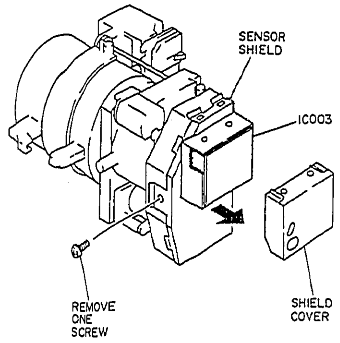

SENSOR SHIELD
IC003
REMOVE ONE SCREW
SHIELD COVER

Fig. 2-15

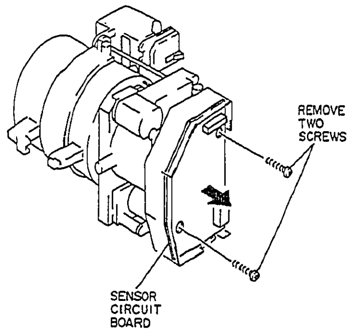

REMOVE TWO SCREWS
SENSOR CIRCUIT BOARD

Fig. 2-16

2. LENS BLOCK DISASSEMBLY

2-1. Auto Focus Circuit Board

1) Remove one (1) screw holding the auto focus circuit board. (See Fig. 2-17)
2) Disconnect four (4) connectors (CN105, CN13AF, CN14AF, CN12AF).
3) Move the auto focus circuit board in the direction of the arrow.
4) Unsolder two (2) connectors (CN02AF, CN01AF).

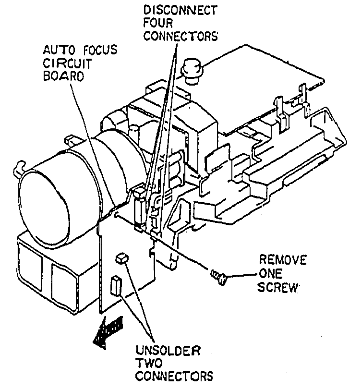

DISCONNECT FOUR CONNECTORS
AUTO FOCUS CIRCUIT BOARD
REMOVE ONE SCREW
UNSOLDER TWO CONNECTORS

Fig. 2-17

2-2. Lens Block

ORDER FOR REMOVING PARTS	ITEM No.
·Sensor Circuit Board	1-13
·Auto Focus Circuit Board	2-1

1) Disconnect connector CN104 on the process circuit board. (See Fig. 2-18)

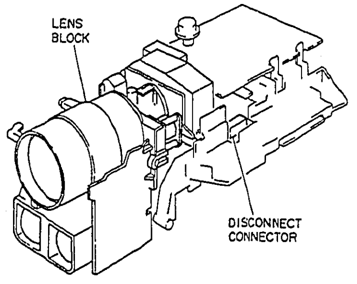

LENS BLOCK
DISCONNECT CONNECTOR

Fig. 2-18

2-3. Focus Motor

ORDER FOR REMOVING PARTS	ITEM No.
·Lens Block	2-2

1) Remove one (1) screw holding the focus motor. (See Fig. 2-19)
2) Remove the focus motor in the direction of the arrow.

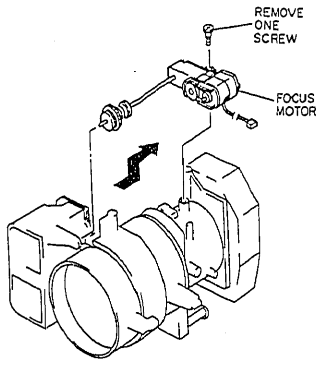

REMOVE ONE SCREW
FOCUS MOTOR

Fig. 2-19

2-4. Zoom Motor

ORDER FOR REMOVING PARTS	ITEM No.
·Lens Block	2-2

1) Remove one (1) screw holding the zoom motor. (See Fig. 2-20)
2) Remove the zoom motor in the direction of the arrow.

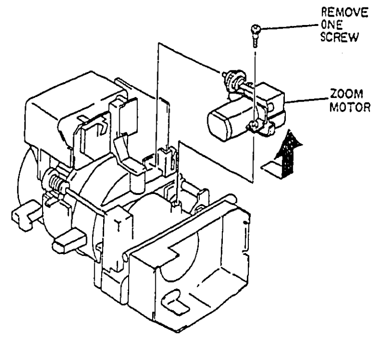

REMOVE ONE SCREW
ZOOM MOTOR

Fig. 2-20

2-5. Iris Block

ORDER FOR REMOVING PARTS	ITEM No.
·Lens Block	2-2

1) Remove one (1) screw holding the iris block. (See Fig. 2-21)
2) Remove the iris block in the direction of the arrow.

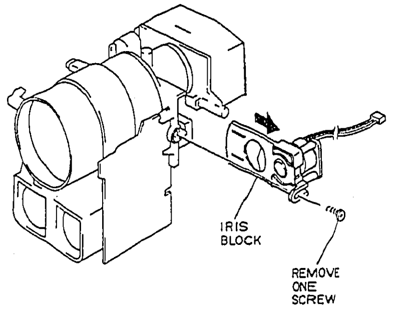

IRIS BLOCK
REMOVE ONE SCREW

Fig. 2-21

3. ELECTRONIC VIEWFINDER (EVF) DISASSEMBLY

3-1. Top Case

1) Remove five (5) screws holding the top case. (See Fig. 2-22)
2) Release the top case in the direction of the arrow.

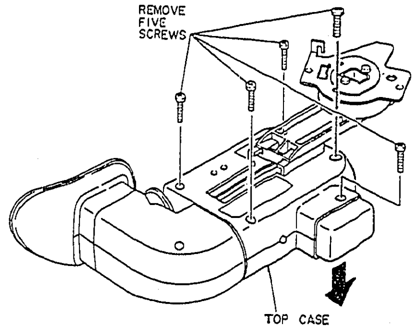

REMOVE FIVE SCREWS
TOP CASE

Fig. 2-22

3-2. Electronic Viewfinder (EVF) Circuit Board

ORDER FOR REMOVING PARTS	*ITEM No.*
·Top Case	3-1

1) Move the CRT in the direction of the arrow and release the cord clamp. (See Fig. 2-23)
2) Remove the EVF circuit board, indi. circuit board and CRT in the direction of the arrow from bottom case.
3) Disconnect two (2) connectors (CN802, CN801) and unsolder connector CN803 on the EVF circuit board.
4) Disconnect CRT socket.

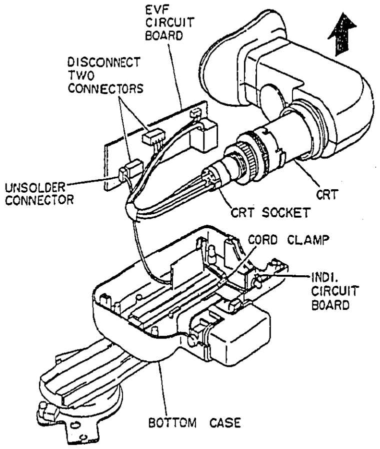

EVF CIRCUIT BOARD
DISCONNECT TWO CONNECTORS
UNSOLDER CONNECTOR
CRT
CRT SOCKET
CORD CLAMP
INDI. CIRCUIT BOARD
BOTTOM CASE

Fig. 2-23

3-3. Mic Assembly

ORDER FOR REMOVING PARTS	*ITEM No.*
·Top Case	3-1

1) Remove the shield plate in the direction of the arrow. (See Fig. 2-24)
2) Disconnect connector CN401 and remove the Mic assembly in the direction of the arrow.

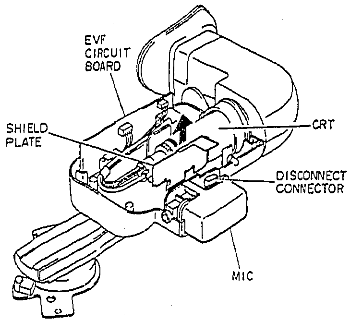

EVF CIRCUIT BOARD
SHIELD PLATE
CRT
DISCONNECT CONNECTOR
MIC

Fig. 2-24

3-4. CRT

ORDER FOR REMOVING PARTS	*ITEM No.*
·Top Case	3-1
·Electronic Viewfinder (EVF) Circuit Board	3-2

1) Push the point (A) on the EVF lens bottom cover and release two (2) tabs and remove the eye cap in the direction of arrow (A). (See Fig. 2-25)
2) Remove one (1) screw holding the EVF lens bottom cover.
3) Open the EVF lens bottom cover in the direction of arrow (B) and remove the CRT from the EVF lens top cover.

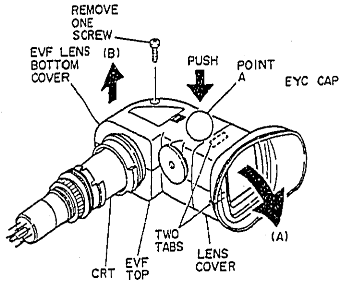

REMOVE ONE SCREW
EVF LENS BOTTOM COVER
(B)
PUSH
POINT A
EYC CAP
TWO TABS
(A)
CRT
EVF TOP
LENS COVER

Fig. 2-25

4. TAPE TRANSPORT MECHANISM DISASSEMBLY

Note: Remove the tape transport mechanism as previously given

TAPE TRANSPORT MECHANISM - TOP VIEW

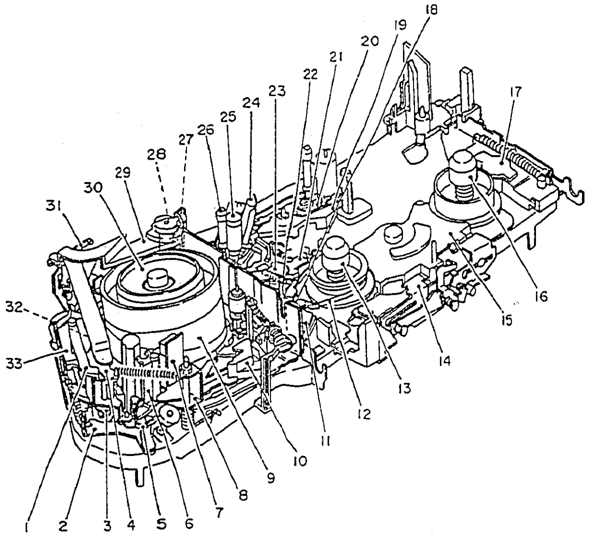

18
19
20
21
22
23
24
25
26
27
28
29
30
31
17
16
15
14
13
12
11
10
9
8
7
32
33
1
2
3
4
5
6

Fig. 2-101

1. Take-up Tension Arm
2. Pressure Roller Compression Link
3. Lock Gear
4. Compression Plate
5. Loading Guide Plate (4)
6. Take-up Guide Pole Stopper
7. Audio/Control Head
8. Audio/Control Head Arm
9. Lower Cylinder
10. Cylinder Base
11. Tension Band Arm
12. Tension Band
13. Supply Reel Table
14. Cassette Holder Lock
15. Reel Block cover
16. Take-up Reel Table
17. Cassette Holder Damper
18. Dew Sensor
19. Pressure Roller Assembly Base
20. Pressure Roller Assembly
21. Supply Sub Brake
22. Tension Spring
23. Tension Arm
24. Supply Slant Pole
25. Take-up Guide Roller
26. Supply Guide Pole
27. Supply Guide Roller
28. Impedance Roller
29. Full Erase Head and Supply End Sensor
30. Upper Cylinder
31. Corner Roller Assembly
32. Loading Guide Plate (5)
33. Loading Guide Plate (3)

TAPE TRANSPORT MECHANISM - BOTTOM VIEW

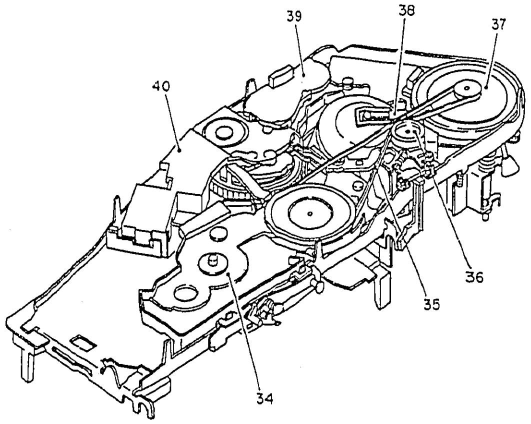

39
38
37
40
36
35
34

Fig. 2-102

34. Reel Gear Block
35. Capstan Belt
36. Impedance Pulley
37. Capstan Motor
38. Static Discharge Brush
39. Mechanical State Switch
40. Loading Gear Block

4-1. Cassette Holder Release

Release one (1) tab, shown in Fig. 2-103, to set the cassette holder to the up position with your hand.
To set the cassette holder to the down position, depress both ends of the cassette holder. Do not push the horizontal bar at the top of the cassette holder.

Note: There are two locking states of the cassette holder - temporary locking and full locking. Temporary locking is a state in which the cassette holder is caught the tab of the cassette holder lock and full locking is a state in which the cassette holder is further pulled in. Either locking can be released by hand. After temporary locking is released, the cassette holder can be locked again, but after full locking is released, the holder cannot be locked again unless the power is applied to move the lock arm to the eject state.

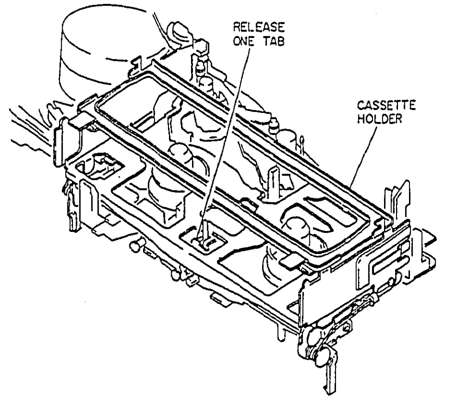

RELEASE ONE TAB
CASSETTE HOLDER

Fig. 2-103

4-2. Cassette Holder

1) Place the cassette holder in the UP position.
2) Remove one (1) screw holding the cassette holder. (See Fig. 2-104)

   Note: Spring (S) is also removed at the time.

3) Remove one (1) screw holding the cassette holder and circuit board holder (T). (See Fig. 2-105)
4) Release circuit board holder (S) in the direction of the arrow. (See Fig. 2-104)
5) Release one (1) tab of the circuit board holder (T) and move the holder in the direction of arrow (A). (See Fig. 2-105)
6) Lift the cassette holder in the direction of arrow (C) to release it from the cassette holder. Then move the cassette holder in the direction of arrow (B) to release the arm (A) pin from the mechanism chassis and the arm (B) pin from the cassette holder bracket. (See Figs. 2-104, 2-105)

   Note: When attaching the arm (A) pin to the mechanism chassis, fit the pin in the recess in the cassette holder damper. (See Fig. 2-105)

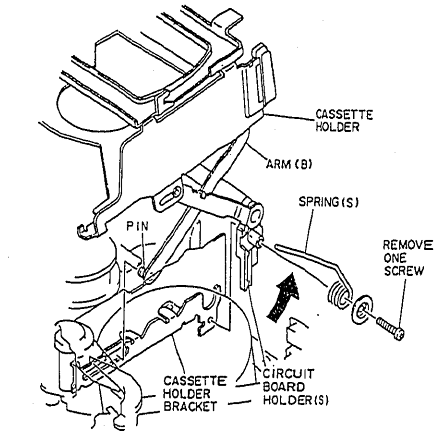

CASSETTE HOLDER
ARM (B)
SPRING (S)
PIN
REMOVE ONE SCREW
CASSETTE HOLDER BRACKET
CIRCUIT BOARD HOLDER (S)

Fig. 2-104

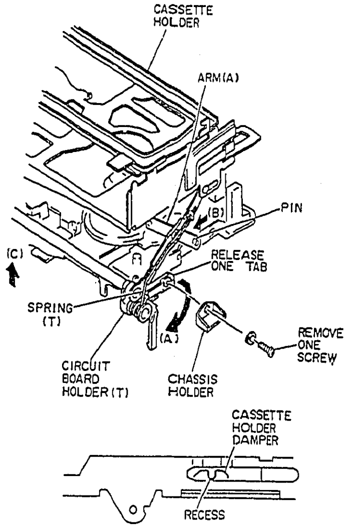

CASSETTE HOLDER
ARM (A)
(B)
PIN
(C)
RELEASE ONE TAB
SPRING (T)
(A)
REMOVE ONE SCREW
CIRCUIT BOARD HOLDER (T)
CHASSIS HOLDER
CASSETTE HOLDER DAMPER
RECESS

Fig. 2-105

4-3. Cassette Holder Bracket

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2

1) Remove one (1) screw holding the cassette holder bracket. (See Fig. 2-106)
2) Move the cassette holder bracket in the direction of arrow (A) to release one (1) tab and then move it in the direction of arrow (B) to release the engagement with the cassette holder bracket.

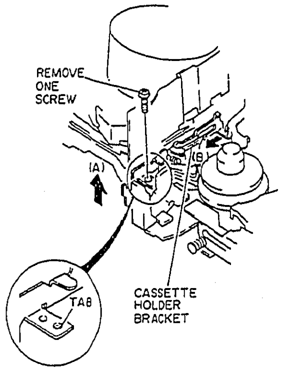

REMOVE ONE SCREW
(A)
(B)
TAB
CASSETTE HOLDER BRACKET

Fig. 2-106

4-4. Full Erase Head, Supply End Sensor and Cleaning Assembly (Dew Sensor)

1) Disconnect three (3) connectors, CN002 and CN001 on the take-up sensor circuit board and CN403 on the main circuit board. (See Fig. 2-107)
2) Remove one (1) screw holding the cleaning assembly (dew sensor).
3) Remove the cleaning assembly (dew sensor).
4) Remove two (2) screws holding the full erase head and supply end sensor.
5) Remove the full erase head and supply end sensor in the direction of the arrow.

Notes:

1. Be careful not to touch the head tips in the cylinder with a screwdriver, etc.
2. After replacing or reinstalling the full erase head, clean each tape contact surface of the full erase head.
3. The unit will not operate for approximately 30 minutes after the dew sensor detects condensation. If the dew sensor is accidentally activated while servicing, reset it by the following procedure.
   1) Place the POWER switch in the VCR position.
   2) Set the unit to EJECT state (the cassette holder to the up position).
   3) Press the safety tab and hold it, then press the tracking control buttons (UP and DOWN) simultaneously.

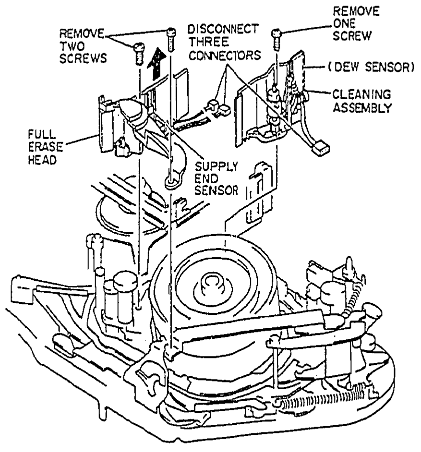

REMOVE TWO SCREWS
DISCONNECT THREE CONNECTORS
REMOVE ONE SCREW
(DEW SENSOR)
CLEANING ASSEMBLY
FULL ERASE HEAD
SUPPLY END SENSOR

Fig. 2-107

4-5. Upper Cylinder (Video Head)

ORDER FOR REMOVING PARTS	*ITEM No.*
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4

1) Remove two (2) screws holding the upper cylinder and pull out the upper cylinder from the lower cylinder in the direction of the arrow. (See Fig. 2-108)

Notes:

1. Be careful that your fingers or tools do not touch the video head tips during work.
2. When installing, match the hole at the weight of the upper cylinder with the pin of the lower cylinder. (See Fig. 2-109)
3. Install the upper cylinder by the reverse procedure to removal.
4. Tighten two (2) upper cylinder holding screws alternately.
5. After replacing or reinstalling the upper cylinder, clean each tape contact surface of the upper cylinder.
6. Perform the following adjustment after reinstalling the upper cylinder assembly.
   CHAPTER 3 MECHANICAL ADJUSTMENT
   4-8. Adjustment After Replacing the Cylinder

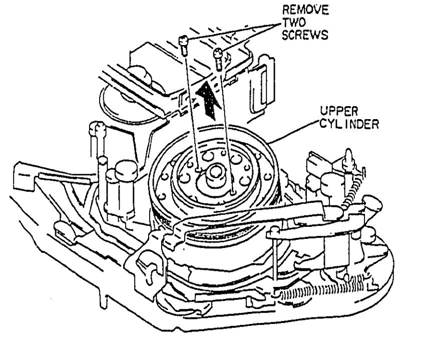

REMOVE TWO SCREWS
UPPER CYLINDER

Fig. 2-108

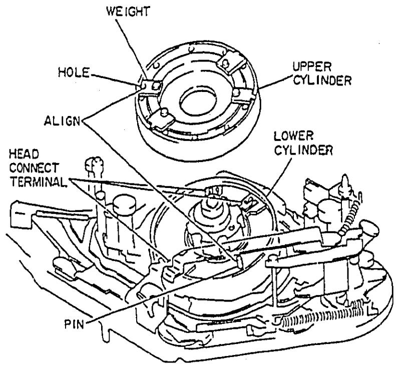

WEIGHT
HOLE
UPPER CYLINDER
ALIGN
LOWER CYLINDER
HEAD CONNECT TERMINAL
PIN

Fig. 2-109

4-6. Lower Cylinder (Cylinder Motor Assembly)

ORDER FOR REMOVING PARTS	ITEM No.
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Upper Cylinder	4-5

1) Disconnect connector CN601. (See Fig. 2-110)
2) Disconnect one (1) flat cable (CN201).
3) Remove three (3) screws holding the lower cylinder.

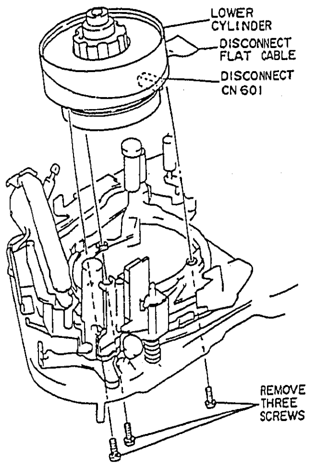

LOWER CYLINDER
DISCONNECT FLAT CABLE
DISCONNECT CN601
REMOVE THREE SCREWS

Fig. 2-110

4-7. Audio/Control (A/C) Head and Audio/Control (A/C) Head Arm

1) Disconnect connector CN402. (See Fig. 2-111)
2) Release the take-up tension arm spring
3) Remove the nut at the top of the A/C head arm.
4) Pull the A/C head arm and A/C head.
5) Remove two (2) screws holding the A/C head.

Notes:

1. When attaching the A/C head to the A/C head arm, tighten screw (D) so the spring of screw (D) is about 6.3mm above the A/C head plate and adjust azimuth screw (B) so the A/C head plate and A/C head arm are parallel.
2. When attaching the spring between A/C head arm and mechanism chassis, hook one end to the projection of the A/C head arm and the other end to the projection of the mechanism chassis.
3. After replacing or reinstalling the A/C head, clean each tape contact surface of the A/C head.
4. Perform the following adjustment after reinstalling the A/C head.
   CHAPTER 3 MECHANICAL ADJUSTMENT
   4-7. Audio/Control Head Adjustment

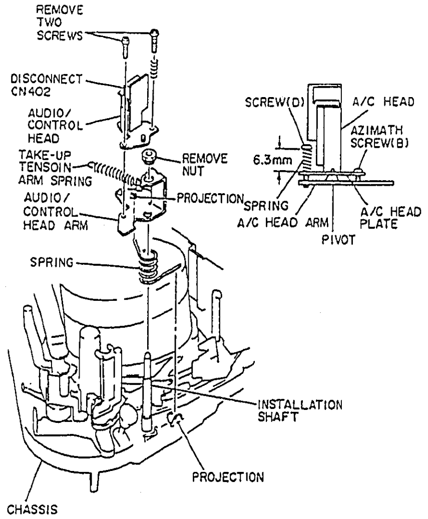

REMOVE TWO SCREWS
DISCONNECT CN402
AUDIO/ CONTROL HEAD
TAKE-UP TENSOIN ARM SPRING
AUDIO/ CONTROL HEAD ARM
REMOVE NUT
PROJECTION
SPRING
SCREW(D)
A/C HEAD
AZIMATH SCREW(B)
6.3mm
SPRING
A/C HEAD ARM
PIVOT
A/C HEAD PLATE
INSTALLATION SHAFT
PROJECTION
CHASSIS

Fig. 2-111

4-8. Impedance Roller

ORDER FOR REMOVING PARTS	ITEM No.
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4

1) Remove one (1) washer and pull the impedance roller. (See Fig. 2-112)

Note: If you touch the roller surface which comes into contact with tape, clean the surface after reinstalling the roller.

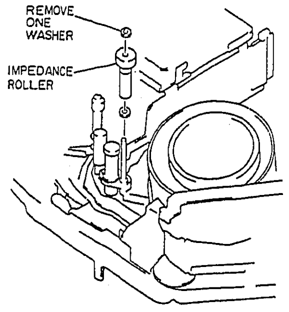

REMOVE ONE WASHER
IMPEDANCE ROLLER

Fig. 2-112

4-9. Supply Guide Roller

ORDER FOR REMOVING PARTS	ITEM No.
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Impedance Roller	4-8

1) Loosen one (1) hex. screw holding the supply guide roller. (See Fig. 2-113)
2) Turn the upper section of the supply guide roller in to counter clockwise using a flat-bladed screwdriver to remove the supply guide roller from the cylinder base.

Notes:

1. If you touch the roller surface which comes into contact with tape, clean the surface after reinstalling the roller.
2. Perform the following adjustment after reinstalling the supply guide roller.
   CHAPTER 3 MECHANICAL ADJUSTMENT
   4-6. Supply and Take-up Guide Rollers Height Adjustment

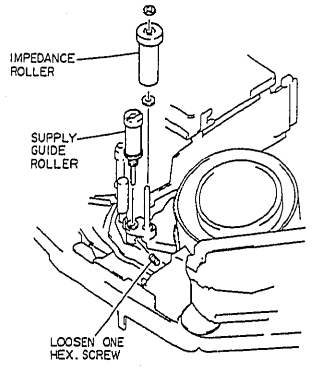

IMPEDANCE ROLLER
SUPPLY GUIDE ROLLER
LOOSEN ONE HEX. SCREW

Fig. 2-113

4-10. Take-up Guide Roller

1) Loosen one (1) hex. screw holding the take-up guide roller. (See Fig. 2-114)
2) Turn the upper section of the take-up guide roller counter clockwise using a flat-bladed screwdriver.

Notes:

1. If you touch the roller surface which comes into contact with tape, clean the surface after reinstalling the roller.
2. Perform the following adjustment after reinstalling the take-up guide roller.
   CHAPTER 3 MECHANICAL ADJUSTMENT
   4-6. Supply and Take-up Guide Rollers Height Adjustment

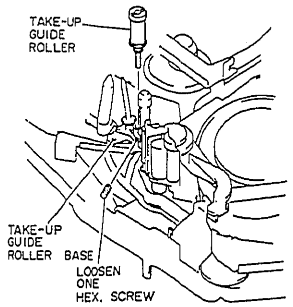

TAKE-UP GUIDE ROLLER
TAKE-UP GUIDE ROLLER BASE
LOOSEN ONE HEX. SCREW

Fig. 2-114

4-11. Tension Arm, Tension Band, Tension Band Arm and Tension Band Release Arm

ORDER FOR REMOVING PARTS	ITEM No.
·Cassette Holder	4-2
·Cassette Holder Bracket	4-3
·Full Erase Head, Supply End sensor, Cleaning Assembly.	4-4

1) Remove one (1) washer holding the tension arm. (See Fig. 2-115)
2) Release the tension spring.
3) Release the tension band spring.
4) Pull the tension arm, tension band and tension band arm from the mechanism chassis.
5) Release one (1) tab on the tension band and remove the tension arm from the tension band.
7) Pull out the pin on the tension band and separate tension band and tension band arm.
8) Pull the tension band release arm from the mechanism chassis.

Note: Perform the following adjustment after reinstalling the tension arm, tension band, tension band arm and tension band release arm.
CHAPTER 3 MECHANICAL ADJUSTMENT
4-2. Tension Arm Position Adjustment
4-3. Tension Adjustment

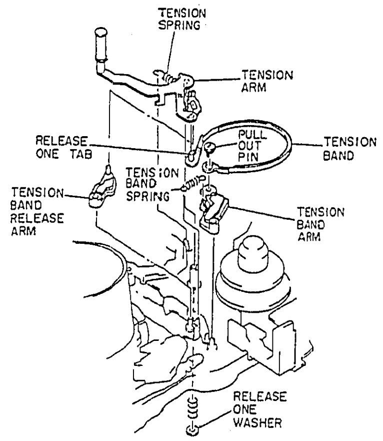

TENSION SPRING
TENSION ARM
RELEASE ONE TAB
PULL OUT PIN
TENSION BAND
TENSION BAND SPRING
TENSION BAND RELEASE ARM
TENSION BAND ARM
RELEASE ONE WASHER

Fig. 2-115

4-12. Cassette Holder Lock

ORDER FOR REMOVING PARTS	ITEM No.
·Cassette Holder	4-2

1) Remove two (2) screws holding the cassette holder lock. (See Fig. 2-116)
2) Remove the cassette holder lock from the mechanism chassis, taking care of the spring.

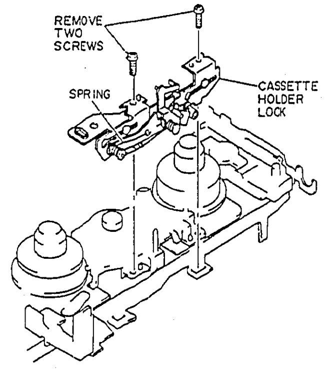

REMOVE TWO SCREWS
SPRING
CASSETTE HOLDER LOCK

Fig. 2-116

4-13. Reel Block Cover

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Lock	4-12

1) Remove one (1) screw holding the reel block cover. (See Fig. 2-117)
2) Release one (1) tab and remove the reel block cover from the mechanism chassis.

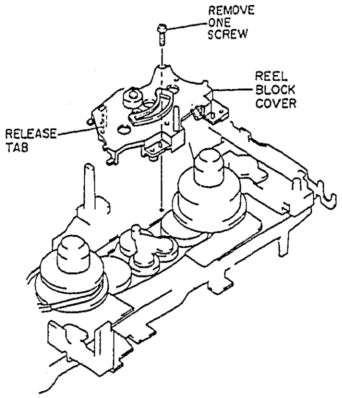

REMOVE ONE SCREW
REEL BLOCK COVER
RELEASE TAB

Fig. 2-117

4-14. Supply and Take-up Reel Tables

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Lock	4-12
·Reel Block Cover	4-13

1) Pull the supply and take-up reel tables from the chassis. (See Fig. 2-118)

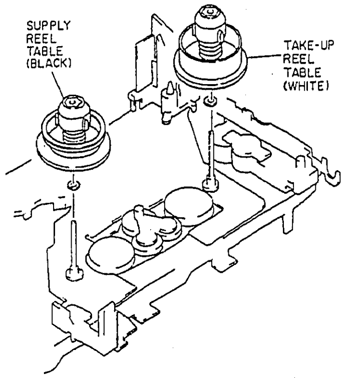

SUPPLY REEL TABLE (BLACK)
TAKE-UP REEL TABLE (WHITE)

Fig. 2-118

4-15. Supply Sub Brake

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2

1) Remove the sub brake spring. (See Fig. 2-119)
2) Turn the supply sub brake in the direction of the arrow.
3) Release one (1) tab and remove the supply sub brake from the mechanism chassis.

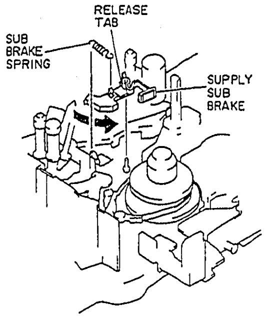

RELEASE TAB
SUB BRAKE SPRING
SUPPLY SUB BRAKE

Fig. 2-119

4-16. Take-up Sensor Circuit Board

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Lock	4-12
·Reel Block Cover	4-13
·Supply and Take-up Reel Tables	4-14
·Supply Sub Brake	4-15

1) Remove two (2) screws and guide holding the take-up sensor circuit board. (See Fig. 2-120)

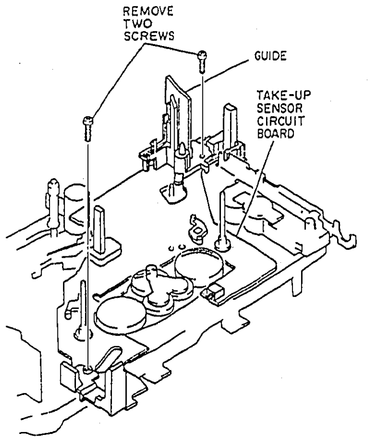

REMOVE TWO SCREWS
GUIDE
TAKE-UP SENSOR CIRCUIT BOARD

Fig. 2-120

4-17. Cassette Holder Damper

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2

1) Push the tab in the direction of arrow (A) and hold it, then move the cassette holder damper in the direction of arrow (B) and remove it from the mechanism chassis. (See Fig. 2-121)

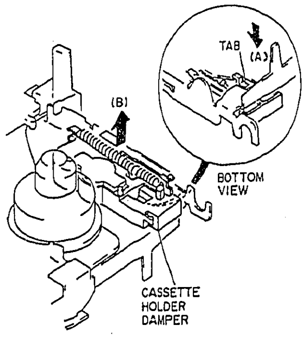

TAB
(A)
(B)
BOTTOM VIEW
CASSETTE HOLDER DAMPER

Fig. 2-121

4-18. Reel Gear Block

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Lock	4-12

1) Release the wires from the wire retainers. (See Fig. 2-122)
2) Remove the spring between the impedance pulley and base loosen the screw holding the impedance pulley, then turn the pulley fully clockwise. (See Fig. 2-123)
3) Remove the capstan belt from the reel gear block, release one (1) tab and remove the cleaning gear arm from the mechanism chassis.
4) Remove four (4) screws holding the reel gear block. (See Fig. 2-124)
5) Release two (2) tabs and remove the reel gear block from the mechanism chassis.

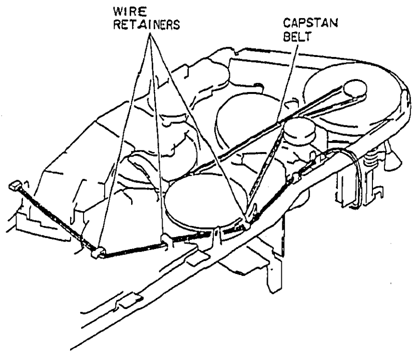

WIRE RETAINERS
CAPSTAN BELT

Fig. 2-122

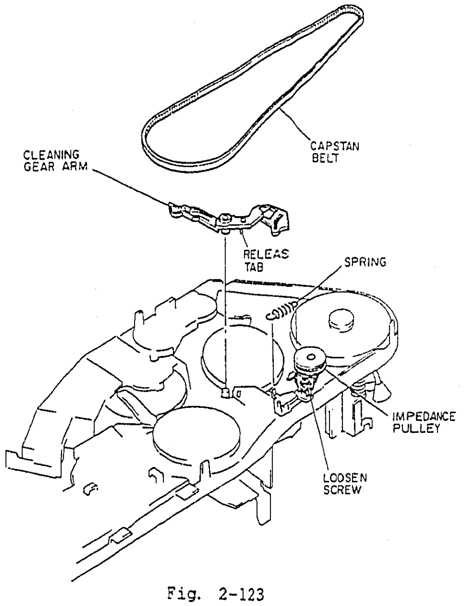

CLEANING GEAR ARM
CAPSTAN BELT
RELEAS TAB
SPRING
IMPEDANCE PULLEY
LOOSEN SCREW

Fig. 2-123

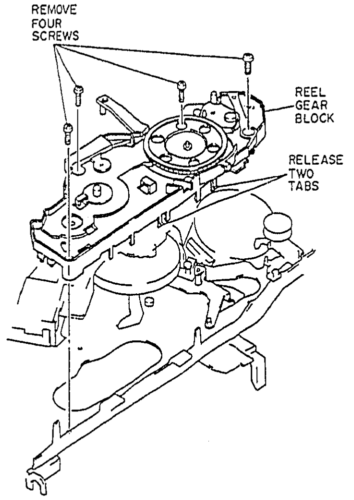

REMOVE FOUR SCREWS
REEL GEAR BLOCK
RELEASE TWO TABS

Fig. 2-124

4-19. Mechanical State Switch

1) Remove one (1) screw holding the mechanism state switch. (See Fig. 2-125)
2) Release two (2) tabs and remove the mechanical state switch from the reel gear block.

Note: Refer to the following adjustment when attaching the mechanical state switch.
CHAPTER 3 MECHANISM ADJUSTMENT
3. PHASE MATCHING ADJUSTMENT

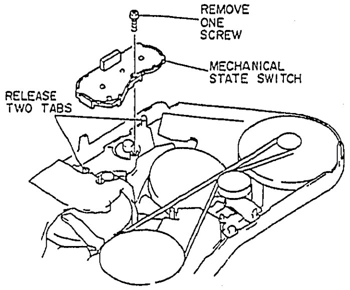

REMOVE ONE SCREW
MECHANICAL STATE SWITCH
RELEASE TWO TABS

Fig. 2-125

4-20. Circuit Board Holder (2)

1) Remove one (1) screw holding the circuit board holder (2). (See Fig. 2-126)

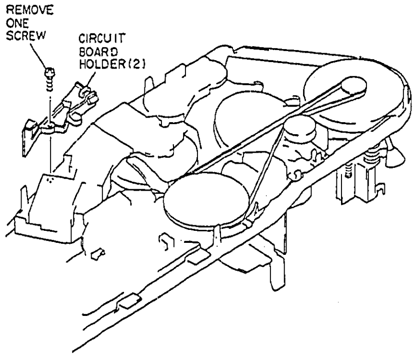

REMOVE ONE SCREW
CIRCUIT BOARD HOLDER(2)

Fig. 2-126

4-21. Loading Gear Block and Cam Arm

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Lock	4-12
·Reel Gear Block	4-13
·Circuit Board Holder (2)	4-20

1) Remove three (3) screws holding the loading gear block. (See Fig. 2-127)
2) Release two (2) tabs and remove the loading gear block from the mechanism chassis.
3) Release the engagement with the pressure roller lock link and remove the cam arm from the mechanism chassis.

Notes:
1. Remove the loading gear block, taking care of the spring of the guide pole arm
2. Before installing the loading gear block, turn the cam arm fully clockwise and the tension band operation arm fully counter clockwise, then adjust the hole in the drive gear of the loading gear block, referring to the Mechanism State Switch and Drive Gear Adjustment in CHAPTER 3 MECHANICAL ADJUSTMENT.
3. When installing the loading gear block, move the guide pole arm in the opposite direction to the operation switch.

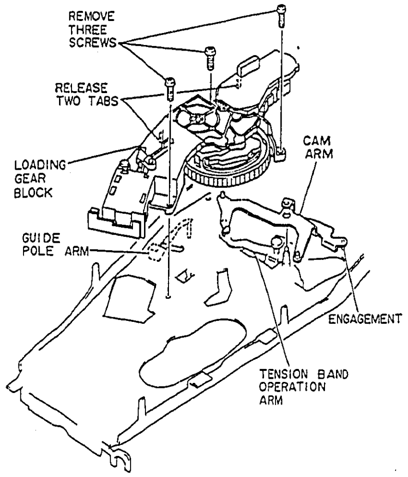

REMOVE THREE SCREWS
RELEASE TWO TABS
LOADING GEAR BLOCK
GUIDE POLE ARM
CAM ARM
ENGAGEMENT
TENSION BAND OPERATION ARM

Fig. 2-127

4-22. Impedance Pulley

ORDER FOR REMOVING PARTS	*ITEM No.*
·Capstan belt	4-18

1) Release the spring between the impedance pulley and base. (See Fig. 2-128)
2) Remove one (1) screw holding the impedance pulley.

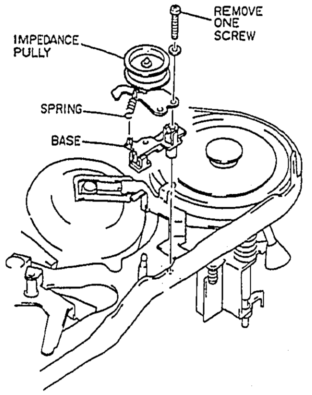

REMOVE ONE SCREW
IMPEDANCE PULLY
SPRING
BASE

Fig. 2-128

4-23. Static Discharge Brush

ORDER FOR REMOVING PARTS	*ITEM No.*
·Capstan belt	4-18

1) Remove one (1) screw holding the static discharge brush. (See Fig. 2-129)

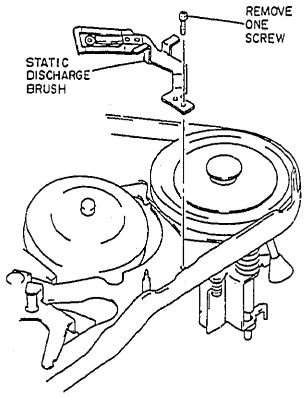

REMOVE ONE SCREW
STATIC DISCHARGE BRUSH

Fig. 2-129

4-24. Compression Plate and Take-up Tension Arm

ORDER FOR REMOVING PARTS	*ITEM No.*
·Full Erase Head, Supply End Sensor, Cleaning Assembly	4-4

1) Remove one (1) screws holding the plate. (See Fig. 2-130)
2) Release the take-up tension arm spring.
3) Remove the compression plate in the direction of the arrow.
4) Release one (1) tab and remove the take-up tension arm from the lock arm.

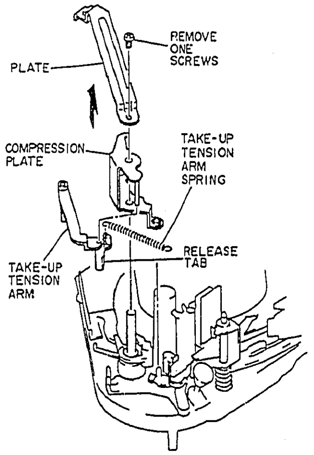


PLATE
REMOVE ONE SCREWS
COMPRESSION PLATE
TAKE-UP TENSION ARM SPRING
RELEASE TAB
TAKE-UP TENSION ARM

Fig. 2-130

4-25. Supply Slant Pole

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Tension Arm, Tension Band, Tension Band Arm, Tension Band Release Arm	4-11

1) Remove one (1) E-ring holding the supply slant pole. (See Fig. 2-131)
2) Remove the supply slant pole in the direction of the arrow.

Note: Refer to the following adjustment when attaching the mechanical state switch.
CHAPTER 3 MECHANISM ADJUSTMENT
3. PHASE MATCHING ADJUSTMENT

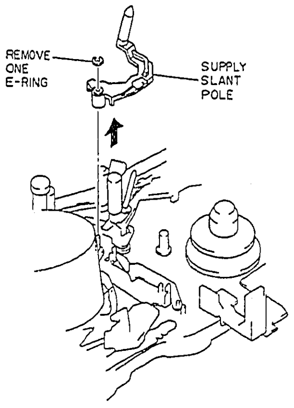

REMOVE ONE E-RING
SUPPLY SLANT POLE

Fig. 2-131

4-26. Loading Guide Plate (2) and Loading Guide Plate (3)

ORDER FOR REMOVING PARTS	*ITEM No.*
·Compression Plate and Take-up Tension Arm	4-24

1) Release the spring between loading guide plate (2) and the pressure roller compression link. (See Fig. 2-132)
2) Remove two (2) screws holding the loading guide plate (2).
3) Release the projection and remove the loading guide plate (2) from the mechanism chassis.
4) Turn the lock gear in the direction of the arrow and hold it, then remove the loading guide plate (3) from the mechanism chassis.

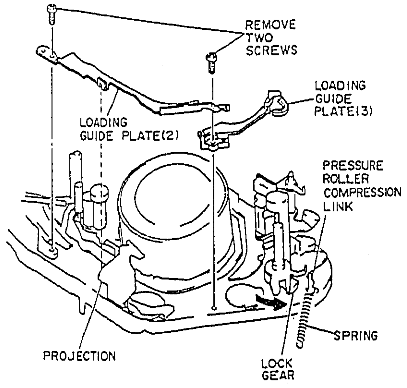

REMOVE TWO SCREWS
LOADING GUIDE PLATE(3)
LOADING GUIDE PLATE(2)
PRESSURE ROLLER COMPRESSION LINK
PROJECTION
SPRING
LOCK GEAR

Fig. 2-132

4-27. Lock Gear

ORDER FOR REMOVING PARTS	*ITEM No.*
·Compression Plate and Take-up Tension Arm	4-24
·Loading Guide Plate (2) and Loading Guide plate (3).	4-26

1) Release the spring between the lock gear and pressure roller lock link. (See Fig. 2-133)
2) Pull the lock gear.

Note: Turn the lock gear fully counter clockwise after reinstalling it.

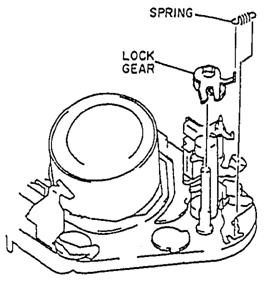

SPRING
LOCK GEAR

Fig. 2-133

4-28. Loading Guide Plate (5)

ORDER FOR REMOVING PARTS	*ITEM No.*
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6

1) Remove two (2) screw holding the loading guide plate (5). (See Fig. 2-134)
2) Release one (1) tab and the engagement with loading guide plate (6), then remove the loading guide plate (5) in the direction of the arrow.

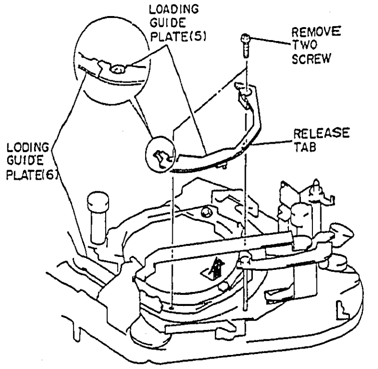

LOADING GUIDE PLATE(5)
REMOVE TWO SCREW
RELEASE TAB
LODING GUIDE PLATE(6)

Fig. 2-134

4-29. Loading Guide Plate (6)

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Bracket	4-3
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6
·Tension Arm, Tension Band, Tension Band Arm, Tension Band Release Arm	4-11
·Supply Slant Pole	4-25
·Loading Guide Plate (5)	4-28

1) Remove two (2) screws holding the loading guide plate (6). (See Fig. 2-135)
2) Release one (1) tab.
3) Move the loading guide plate (6) on the direction of arrow (A) to release the engagement section, then turn the guide pole arm clockwise and remove the loading guide plate (6) in the direction of arrow (B).

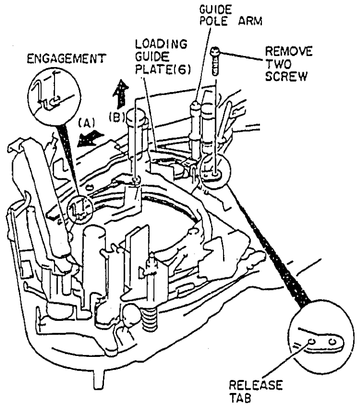

GUIDE POLE ARM
ENGAGEMENT
LOADING GUIDE PLATE(6)
REMOVE TWO SCREW
(A)
(B)
RELEASE TAB

Fig. 2-135

4-30. Cylinder Base

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Bracket	4-3
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6
·Impedance Roller	4-8
·Supply Guide Roller	4-9
·Tension Arm, Tension Band, Tension Band Arm, Tension Band Release Arm	4-11
·Supply Slant Pole	4-25
·Loading Guide Plate (5)	4-28
·Loading Guide Plate (6)	4-29

1) Remove two (2) screws holding the cylinder base and remove the mechanism chassis. (See Fig. 2-136)

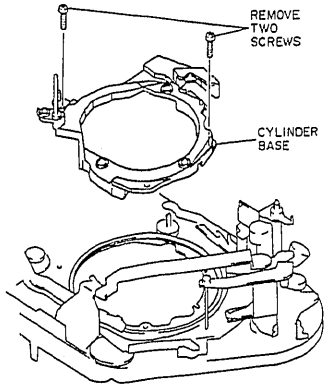

REMOVE TWO SCREWS
CYLINDER BASE

Fig. 2-136

4-31. Pressure Roller Assembly, Take-up Guide Roller and Loading link

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Bracket	4-3
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6
·Tension Arm, Tension Band, Tension Band Arm, Tension Band Release Arm	4-11
·Supply Slant Pole	4-25
·Loading Guide Plate (2) and Loading Guide Plate (3).	4-26
·Loading Guide Plate (5)	4-28
·Loading Guide Plate (6)	4-29
·Cylinder Base	4-30

1) Remove three (3) screws holding the pressure roller assembly base. (See Fig. 2-137)
2) Remove one (1) E-ring holding the loading link.
3) Turn the guide pole arm clockwise, then remove the pressure roller assembly base from the mechanism chassis.
4) Move the pressure roller assembly, take-up guide roller and loading link in the direction of the arrow. (See Fig. 2-138)
5) Release one (1) washer and remove the take-up guide roller and loading link.

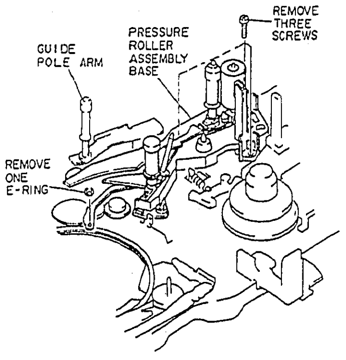

REMOVE THREE SCREWS
PRESSURE ROLLER ASSEMBLY BASE
GUIDE POLE ARM
REMOVE ONE E-RING

Fig. 2-137

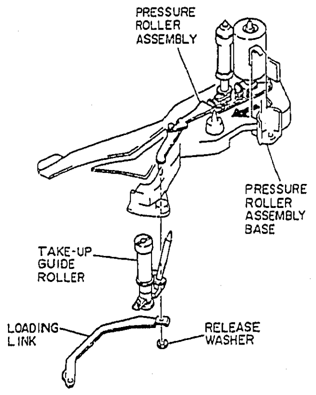

PRESSURE ROLLER ASSEMBLY
PRESSURE ROLLER ASSEMBLY BASE
TAKE-UP GUIDE ROLLER
LOADING LINK
RELEASE WASHER

Fig. 2-138

4-32. Guide Pole Arm

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Cassette Holder Bracket	4-3
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6
·Tension Arm, Tension Band, Tension Band Arm, Tension Band Release Arm	4-11
·Supply Slant Pole	4-25
·Loading Guide Plate (2) and Loading Guide Plate (3).	4-26
·Loading Guide Plate (5)	4-28
·Loading Guide Plate (6)	4-29
·Cylinder Base	4-30
·Pressure Roller Assembly, Take-up Guide roller, Loading Link	4-31

1) Release the spring from the guide pole arm operation arm. (See Fig. 2-139)
2) Release one (1) washer and out the guide pole arm.

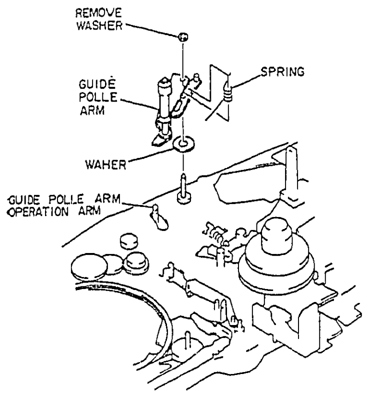

REMOVE WASHER
GUIDE POLLE ARM
SPRING
WAHER
GUIDE POLLE ARM OPERATION ARM

Fig. 2-139

4-33. Gear (1), Gear (2) and Gear (3)

ORDER FOR REMOVING PARTS	*ITEM No.*
·Cassette Holder	4-2
·Full Erase Head, Supply End Sensor, Cleaning Assembly.	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6
·Loading Guide Plate (5)	4-28
·Loading Guide Plate (6)	4-29
·Cylinder Base	4-30
·Pressure Roller Assembly, Take-up Guide roller, Loading Link	4-31

1) Pull the gear (3). (See Fig. 2-140)
2) Remove one (1) washer and pull out the gear (1) and gear (2) from the mechanism chassis.

Note: Refer to the following adjustment when attaching the gear (3).
CHAPTER 3 MECHANICAL ADJUSTMENT
3. PHASE MATCHING IN ASSEMBLY

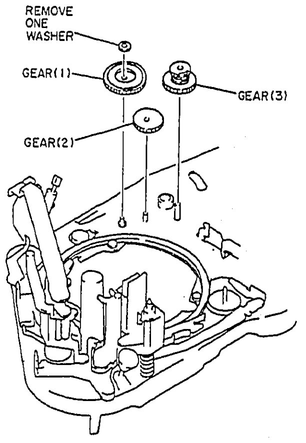

REMOVE ONE WASHER
GEAR(1)
GEAR(3)
GEAR(2)

Fig. 2-140

4-34. Corner Roller Assembly

ORDER FOR REMOVING PARTS	ITEM No.
·Compression Plate, Take-up Tension Arm	4-24
·Loading Guide Plate (2), Loading Guide Plate (3)	4-26

1) Remove one (1) screw holding the corner roller. (See Fig. 2-141)
2) Remove the corner roller in the direction of the arrow.

Note: Refer to the following adjustment when attaching the corner roller assembly.
CHAPTER 3 MECHANICAL ADJUSTMENT
3. PHASE MATCHING IN ASSEMBLY

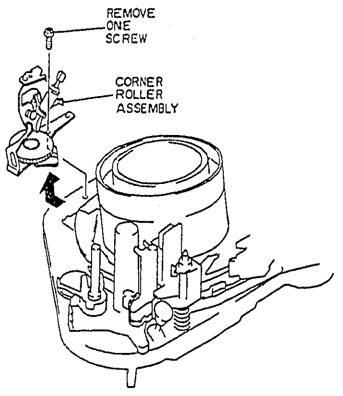

REMOVE ONE SCREW
CORNER ROLLER ASSEMBLY

Fig. 2-141

4-35. Loading Guide Plate (4)

ORDER FOR REMOVING PARTS	ITEM No.
·Audio/Control Head Arm	4-7

1) Remove one (1) screw holding the loading guide plate (4). (See Fig. 2-142)
2) Release one (1) hook and remove the loading guide plate (4) from the mechanism chassis in the direction of the arrow.

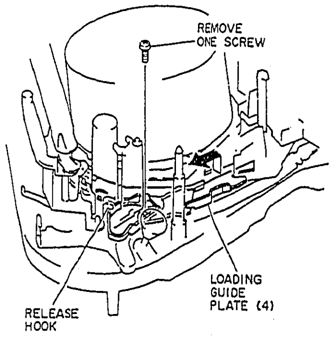

REMOVE ONE SCREW
LOADING GUIDE PLATE (4)
RELEASE HOOK

Fig. 2-142

4-36. Capstan Motor

ORDER FOR REMOVING PARTS	ITEM No.
·Full Erase Head, Supply End Sensor, Cleaning Assembly	4-4
·Audio/Control Head Arm	4-7
·Capstan Belt	4-18
·Static Discharge Brush	4-23
·Compression Plate, Take-up Tension Arm	4-24
·Loading Guide Plate (2), Loading Guide Plate (3)	4-26
·Lock Gear	4-27
·Loading Guide Plate (4)	4-35

1) Remove one (1) screw holding the capstan motor. (See Fig. 2-143)
2) Remove three (3) screws holding the capstan motor.

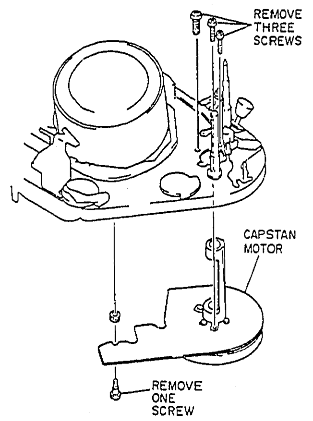

REMOVE THREE SCREWS
CAPSTAN MOTOR
REMOVE ONE SCREW

Fig. 2-143

4-37. Take-up Guide Pole Stopper

ORDER FOR REMOVING PARTS	ITEM No.
·Audio/Control Head Arm	4-7

1) Remove the nut at the top of the take-up guide pole stopper. (See Fog. 2-144)
2) Release one (1) hook and pull the take-up guide pole stopper.

Notes:
1. When installing it, leave a distance of 33.1mm ± 0.05mm between the top of the take-up guide pole stopper and the mechanism chassis.
2. Perform the following adjustment after reinstalling the take-up guide pole stopper.
CHAPTER 3 MECHANICAL ADJUSTMENT
4-5. Take-up Guide Pole Stopper Height Adjustment

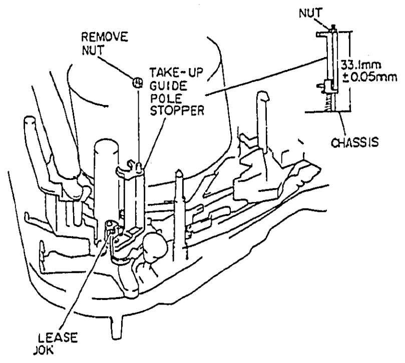

NUT
REMOVE NUT
TAKE-UP GUIDE POLE STOPPER
33.1mm ±0.05mm
CHASSIS
LEASE
JOK

Fig. 2-144

4-38. Pressure Roller Compression Link

ORDER FOR REMOVING PARTS	ITEM No.
·Cassette Holder	4-2
·Cassette Holder Bracket	4-3
·Full Erase Head, Supply End Sensor, Cleaning Assembly	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6
·Audio/Control Head Arm	4-7
·Tension Arm, Tension Band, Tension Band Arm, Tension Band Release Arm	4-11
·Compression Plate, Take-up Tension Arm	4-24
·Supply Slant Pole	4-25
·Loading Guide Plate (5)	4-28
·Loading Guide Plate (6)	4-29
·Cylinder Base	4-30
·Loading Guide Plate (4)	4-35
·Take-up Guide Pole Stopper	4-37

1) Remove two (2) springs between the loading guide plate (2) and the pressure roller compression link and between the lock gear and the pressure roller compression link. (See Fig. 2-145)
2) Remove one (1) washer and remove the pressure roller compression link in the direction of the arrow.

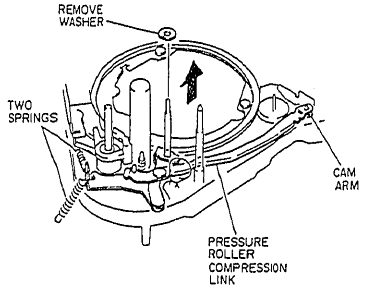

REMOVE WASHER
TWO SPRINGS
CAM ARM
PRESSURE ROLLER COMPRESSION LINK

Fig. 2-145

4-39. Loading Ring Assembly

ORDER FOR REMOVING PARTS	ITEM No.
·Cassette Holder	4-2
·Cassette Holder Bracket	4-3
·Full Erase Head, Supply End Sensor, Cleaning Assembly	4-4
·Upper Cylinder	4-5
·Lower Cylinder	4-6
·Audio/Control Head Arm	4-7
·Tension Arm, Tension Band, Tension Band Arm, Tension Band Release Arm	4-11
·Loading Guide Plate (2), Loading Guide Plate (3)	4-26
·Supply Slant Pole	4-25
·Loading Guide Plate (5)	4-28
·Loading Guide Plate (6)	4-29
·Cylinder Base	4-30
·Pressure Roller Assembly, Take-up Guide Roller, Loading Link	4-31
·Gear (1)	4-33
·Corner Roller Assembly	4-34
·Loading Guide Plate (4)	4-35

1) Remove three (3) washers and remove the loading ring assembly from the mechanism chassis. (See Fig. 2-146)

Note: Refer to the following adjustment when attaching the loading ring assembly.
CHAPTER 3 MECHANICAL ADJUSTMENT
3. PHASE MATCHING IN ASSEMBLY

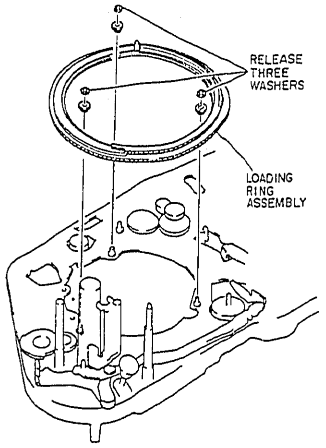
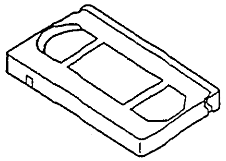
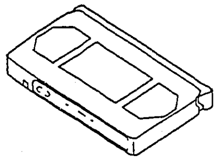
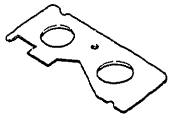
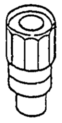
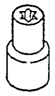
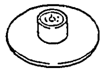
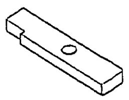
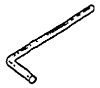
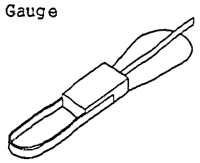
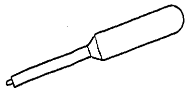
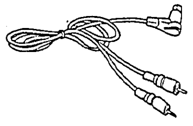
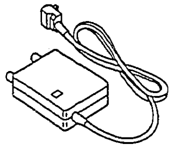
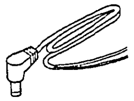
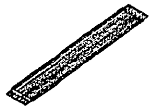
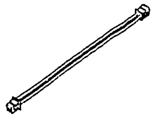
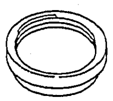

RELEASE THREE WASHERS
LOADING RING ASSEMBLY

Fig. 2-146

JIG AND TAPES FOR ADJUSTMENT

1. Back Tension Meter Parts No. 7099004 	2. Alignment Tape (MH-1) Parts No. 7099046 	3. Master Plane Parts No. 7099279 	4. Torque Gauge Parts No. 7099039 
5. Torque Gauge Adapter Parts No. 7099204 	6. Dummy Reel Parts No. 7099043 	7. Reel Disk Height Jig Parts No. 7099038 	8. Hexagonal Wrench 
9. Fan Type Tension Gauge 	10. Back Focus Adjustment Driver Parts No. 7099205 	11. AV Input Cable 	12. RF Converter Unit 
13. Ext. Power Cable Parts No. 7099326 	14. Extension Cable 15pin Parts No. 7099436 11pin Parts No. 7099437 	15. Extension Cable 2pin Parts No. 7099438 	16. Light Balancing Filter 

CHAPTER 3 MECHANICAL ADJUSTMENT

1. BEFORE STARTING ADJUSTMENT

·Remove the components shown in the table below beforhand, referring to the CHAPTER 2 DISASSEMBLY.

ORDER FOR REMOVING PARTS	ITEM No.
·Left Case	1-1
·Front Cover	1-2
·Electronic Viewfinder (EVF)	1-3
·Cassette Lid	1-7
·Right Case	1-8

·To set the unit to the play mode without loading a cassette, shut off the light from the end LED located midway on the tape mechanism.

2. CAM ARM AND TENSION BAND ARM OPERATION ARM POSITION SET (Fig. 3-1)

Be sure to perform this position set when reinstalling the loading bear block.

POSITION SET PROCEDURE:

1) Turn the cam arm clockwise until it is stopped by the stopper.
2) Turn the tension band arm operation arm counter clockwise until it is stopped by the stopper.

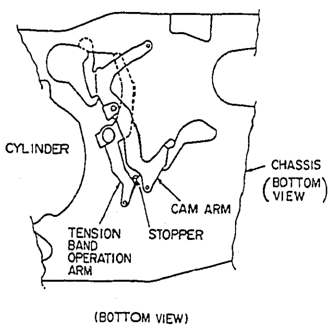

CYLINDER
CHASSIS
(BOTTOM VIEW)
CAM ARM
TENSION BAND OPERATION ARM
STOPPER
(BOTTOM VIEW)

Fig. 3-1

3. PHASE MATCHING IN ASSEMBLY (Figs. 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, 3-8)

Be sure to match the phase when reinstalling the mechanism state switch, drive gear, loading ring, lock plate drive gear, corner roller assembly, gear(1), gear(3) and supply slant pole.

REINSTALLING PROCEDURE:

Mechanism State Switch, Drive Gear (See Figs. 3-2, 3-3, 3-4)

1) Align mark (A) on the mechanism state switch and groove (E), and mark (C) and groove (F). Check that tooth (B) on rotor (G) can be seen at the center of groove (E) and tooth (D) on rotor (H) can be seen at the center of groove (F). (See Fig. 3-2)
2) Attach the drive gear so the hole in the drive gear is aligned with hole (I) in the loading block assembly. Check that two (2) pins of the guide pin operation arm are inserted into the grooves in the drive gear. (See Fig. 3-3)
3) Align mark (J) on the drive gear and mark (K) on mode gear (1). Also align holes(L) and (M) in mode gear (1) with the holes in the loading block assembly.
4) Adjust mode gear (2) so that mark (R) on mode gear (2) cam be seen through hole (S) in mode gear(3). Check that mark (N) on mode (2) can be seen through hole (P) in the loading block assembly.
5) Attach the mechanism state switch to the loading block assembly so that post (T) of mode gear (3) is inserted into groove (E) and post (V) of mode gear (1) is inserted into groove (F). (See Fig. 3-4)

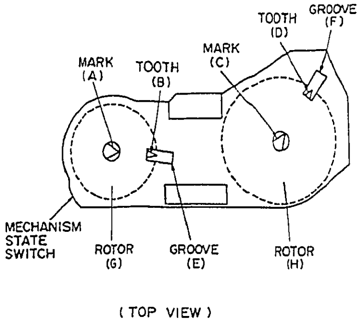

MARK (A)
TOOTH (B)
MARK (C)
TOOTH (D)
GROOVE (F)
MECHANISM STATE SWITCH
ROTOR (G)
GROOVE (E)
ROTOR (H)
(TOP VIEW)

Fig. 3-2

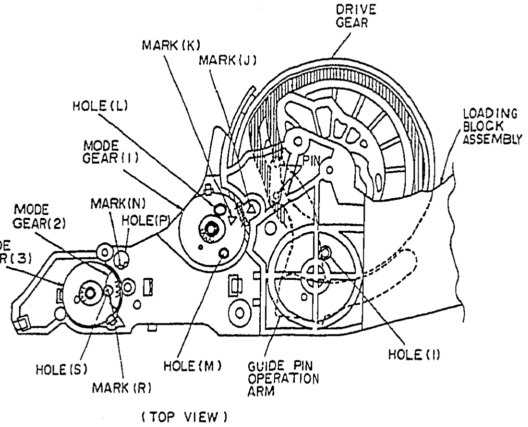

DRIVE GEAR
MARK (K)
MARK (J)
HOLE (L)
LOADING BLOCK ASSEMBLY
MODE GEAR (1)
PIN
MODE GEAR (2)
MARK (N)
HOLE (P)
MODE GEAR (3)
HOLE (S)
MARK (R)
HOLE (M)
GUIDE PIN OPERATION ARM
HOLE (I)
(TOP VIEW)

Fig. 3-3

〈Continued〉

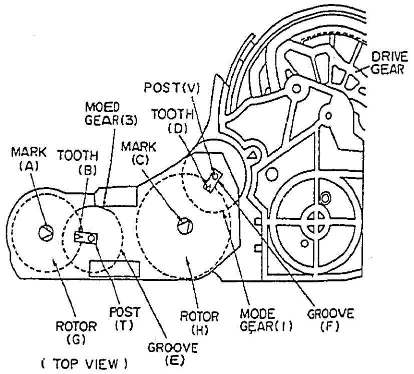

DRIVE GEAR
POST(V)
MOED GEAR(3)
TOOTH (D)
MARK (A)
TOOTH (B)
MARK (C)
ROTOR (G)
POST (T)
ROTOR (H)
MODE GEAR(1)
GROOVE (F)
GROOVE (E)
(TOP VIEW)

Fig. 3-4

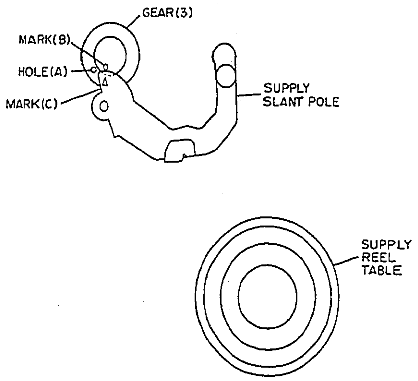

GEAR(3)
MARK(B)
HOLE(A)
MARK(C)
SUPPLY SLANT POLE
SUPPLY REEL TABLE

Fig. 3-5

Gear (3), Supply Slant Pole (See Fig. 3-5)

6) Align hole (A) in gear (3) with the hole in the mechanism chassis, then align mark (B) on gear (3) and mark (C) on the supply slant pole.

Loading Ring (See Figs. 3-6, 3-7)

7) Align hole (D) in the lock gear drive gear with the hole in the mechanism chassis.
8) Align hole (E) in the loading ring and the hole in the mechanism chassis, then align mark (Z) on the loading ring and mark (W) on mode gear (2).

Corner Roller Assembly, Gear (1) (See Fig. 3-8)

9) Turn the corner roller drive gear fully counter clockwise and tilt corner roller by 45° so that projections (A) and (B) of the corner roller come into contact with the loading ring.
10) Mark both projections (C) and (D) of gear (1) come into contact with the loading ring.

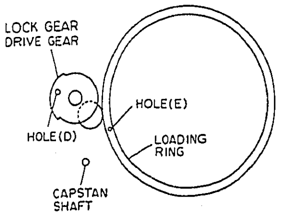

LOCK GEAR DRIVE GEAR
HOLE(E)
HOLE(D)
LOADING RING
CAPSTAN SHAFT

Fig. 3-6

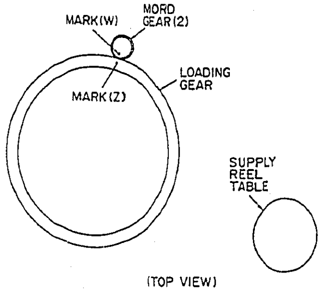

MARK(W)
MORD GEAR(2)
LOADING GEAR
MARK(Z)
SUPPLY REEL TABLE
(TOP VIEW)

Fig. 3-7

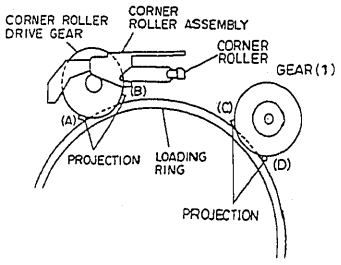

CORNER ROLLER DRIVE GEAR
CORNER ROLLER ASSEMBLY
CORNER ROLLER
GEAR(1)
(B)
(A)
(C)
PROJECTION
LOADING RING
(D)
PROJECTION

Fig. 3-8

4. TAPE TRANSPORT SYSTEM CHECK/ADJUSTMENT

The tape transport system is the path from the supply reel to the take-up reel via the video heads. The tape transport components, especially the components which come into direct contact with the tape, should be kept clean without damage, dust and oil, etc. adhering to the contact surface. The tape transport system is adjusted before shipment from the factory, so when any transport components are replaced, the transport system is stabilized by correctly adjusting the new components.

4-1. Reel Disk Height Adjustment (Fig. 3-9)

Be sure to perform this adjustment after reinstalling the supply or take-up reel disk.

PURPOSE		*FAULT DUE TO INCOMPLETE ADJUSTMENT*	
To set the reel disk height to the specified value.		Tape is not loading normally.	
TEST EQUIPMENT/JIG	*STATE OF VCR*	*TEST POINTS*	*ADJUSTMENT POINTS*
·Master Plane ·Reel Disk Height Jig	·Shut off the light from the END LED ·Mount the master plane, lower the cassette holder to set the unit to the loading state.		

〈Continued〉

ADJUSTMENT PROCEDURE:

Note: Use the same procedure for the supply and take-up side

1) Fit the reel disk height jig to the reel disk as shown in Fig. 3-9.
2) Adjust the washer (2types: 0.25mm and 0.5mm thick) at the bottom of the reel disk so that top of the reel disk is between (A) and (B) of the reel disk height jig.

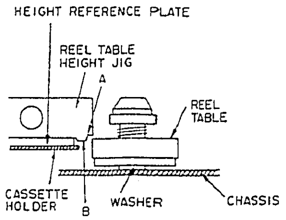

HEIGHT REFERENCE PLATE
REEL TABLE HEIGHT JIG
A
REEL TABLE
CASSETTE HOLDER
B
WASHER
CHASSIS

Fig. 3-9

4-2. Tension Arm Position Adjustment (Figs. 3-10, 3-11)

Be sure to perform this adjustment after reinstalling the tension arm and tension band and supply reel disk.

PURPOSE		*FAULT DUE TO INCOMPLETE ADJUSTMENT*	
To set the tape tension to the specified value.		Tape is not loading normally	
TEST EQUIPMENT/JIG	*STATE OF VCR*	*TEST POINTS*	*ADJUSTMENT POINTS*
·Master Plane ·Reel Disk Height Jig	·shut off the light from the END LED.		

ADJUSTMENT PROCEDURE:

1) Set the cassette holder to the up position and press the lock regulation arm of the cassette holder lock to set the camera/recorder to the loading state and plase in "Play" mode.
2) While pushing the tension band arm counter clockwise, insert the adjustment screwdriver into the adjustment point and align the end of the tension roller with mark(2) on the guide pole arm.

Notes:1. Move within the range shown by arrows when adjusting.
2. After adjustment is completed, check that the end of the tension roller is positioned between mark(2) and (3).

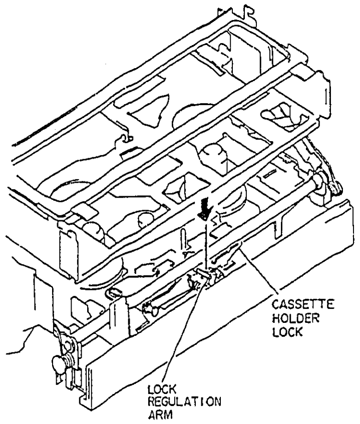

CASSETTE HOLDER LOCK
LOCK REGULATION ARM

Fig. 3-10

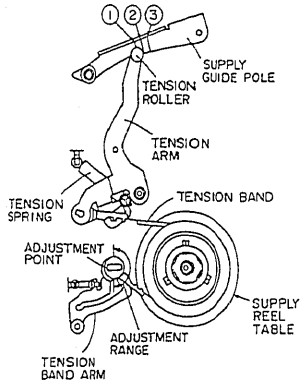

①②③
SUPPLY GUIDE POLE
TENSION ROLLER
TENSION ARM
TENSION SPRING
TENSION BAND
ADJUSTMENT POINT
SUPPLY REEL TABLE
ADJUSTMENT RANGE
TENSION BAND ARM

Fig. 3-11

4-3. Tension Adjustment

Be sure to perform this adjustment after reinstalling the tension arm and tension band arm supply reel disk.

PURPOSE		*FAULT DUE TO INCOMPLETE ADJUSTMENT*	
To set the tape tension to the specified value.		Tape is not loaded normally	
TEST EQUIPMENT/JIG	*STATE OF VCR*	*TEST POINTS*	*ADJUSTMENT POINTS*
·Back Tension Meter			

ADJUSTMENT PROCEDURE:

1) Load instrument with the back tension meter and place in "play" mode.
2) Check the supply-side scale.
3) This reading should be between 26 and 33.
4) If the back tension is not within the specification replace the tension spring with that in the service parts.
5) Check the tension arm position when the backtension is changed.

Notes:1. The instrument must be in a horizontal position for this adjustment.
2. Complete the tension arm position adjustment before performing the back tension adjustment.

4-4. Supply Guide Pole Height Adjustment (Fig. 3-12)

Be sure to perform this adjustment after reinstalling the supply guide pole

PURPOSE		*FAULT DUE TO INCOMPLETE ADJUSTMENT*	
To set height relative to the cylinder.		The play back picture distorted.	
TEST EQUIPMENT/JIG	*STATE OF VCR*	*TEST POINTS*	*ADJUSTMENT POINTS*
·Blank Tape			

ADJUSTMENT PROCEDURE:

1) Load instrument with a blank tape and place in "play" mode.
2) Check that no curling and creasing of tape occurs around supply guide pole. If curling and creasing occurs, turn the nut on the top of the supply guide pole using the adjustment screwdriver to fine adjust their heights.

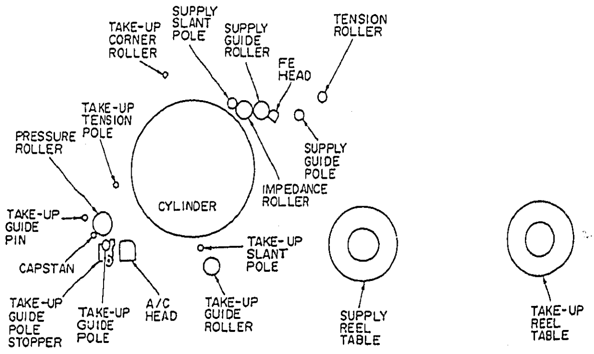


Fig. 3-12

4-5. Take-up Guide Pole Stopper Height Adjustment (Fig. 3-12)

Be sure to perform this adjustment after reinstalling the take-up guide pole stopper

PURPOSE		*FAULT DUE TO INCOMPLETE ADJUSTMENT*	
To set height relative to the cylinder.		The play back picture distorted.	
TEST EQUIPMENT/JIG	*STATE OF VCR*	*TEST POINTS*	*ADJUSTMENT POINTS*
·Blank Tape			

ADJUSTMENT PROCEDURE:

1) Load instrument with a blank tape and place in "play" mode.
2) Check that the tape is running at the center of the take-up guide pole. If this cannot be confirmed, adjust the nut at the top of the take-up guide pole stopper.

4-6. Supply and Take-up Guide Rollers Height Adjustments (Figs. 3-12, 3-13)

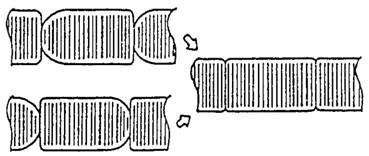
Be sure to perform this adjustment after reinstalling the supply and take-up guide rollers

Note: Press the two tracking control buttons (UP and DOWN) simultaneously to set the tracking to center in this model.

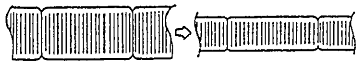
PURPOSE		FAULT DUE TO INCOMPLETE ADJUSTMENT	
To set height relative to the cylinder.		The play back picture distorted.	
TEST EQUIPMENT/JIG	STATE OF VCR	TEST POINTS	ADJUSTMENT POINTS
·Blank Tape ·Alignment Tape (MH-1) ·Oscilloscope		TP204 MAIN TP207 (SW30Hz) MAIN	

ADJUSTMENT PROCEDURE:

1) Load instrument with a blank tape and place in "play" mode.
2) Check that no curling and creasing of tape occurs around supply guide roller and take-up guide roller. If curing and creasing occurs, loosen the hex screws at the base of each guide rollers and turn the top of the supply guide roller and take-up guide roller using a bladed screwdriver to fine adjust their heights. (See Fig. 3-12)
3) Connect the oscilloscope to TP204.
4) Trigger the oscilloscope to TP207 (SW30Hz).
5) Press the two tracking control buttons (UP and DOWN) simultaneously.
6) Load instrument with the alignment tape which was fully rewind and place in "play" mode.
7) Check that FM envelope waveform at TP204 is flat. Press tracking control buttons UP and DOWN to check that FM envelope level drops at an equal angle on the UP and DOWN. (See Fig. 3-13)
8) If the specification in step 7) cannot be confirmed, turn the tops of supply guide roller and take-up guide roller using a bladed screwdriver to adjust their heights so the specification in step 7) can be satisfied.
9) After adjust tighten the hex screw at the base of each guide roller.



Turn guide roller height adjustment screw a little at a time to flatten waveform.



Tracking control at centered. Prees the trackig control bottons to the UP and DOWN.

Fig. 3-13

〈Continued〉

4-7. Audio/Control Head Adjustment (Fig. 3-14, 3-15, 3-16)

Perform the height, tilt and azimuth adjustments repeatedly to determine the A/C head installation position, then adjust the X-value.

Detailed adjustment below is the procedure when the A/C head is replaced; be sure to do precise adjustment after rough adjustment.

Note: Press the two tracking control buttons (UP and DOWN) simultaneously to set the tracking to center in this model.

PURPOSE:		*FAULT DUE TO INCOMPLETE ADJUSTMENT:*	
To set the tape tension to the specified value.		Tape is not loaded normally.	
TEST EQUIPMENT/JIG	*STATE OF VCR*	*TEST POINTS*	*ADJUSTMENT POINTS*
·Alignment Tape (MH-1) ·Oscilloscope		·TP204 MAIN ·TP207 (SW30Hz) MAIN	

ADJUSTMENT PROCEDURE:

Rough Adjustment (See Fig. 3-14)

1) Adjust HEIGHT NUT (A) so that there is 15.4mm between the A/C head plate and chassis.
2) Adjust AZIMUTH SCREW (B), TILT HEX. SCREW (C) and SCREW (D) so that A/C head arm and A/C head plate are parallel.

Precise Adjustment (See Figs. 3-14, 3-15)

3) Connect oscilloscope to audio output (AV OUT).
4) Load alignment tape and playback a 1 kHz audio signal (color bar signal).
5) Alternately adjust HEIGHT NUT (A), AZIMUTH SCREW (B) and TILT HEX. SCREW (C) for maximum output.

X-value Adjustment (See Figs. 3-14, 3-16)

1) Connect the oscilloscope to TP204.
2) Trigger the oscilloscope to TP207 (SW30Hz).
3) Press the two tracking control buttons (UP and DOWN) simultaneously.
4) Playback a monoscope signal on alignment tape.
5) Adjust the X-VALUE ADJUST NUT so that the output at TP204 (FM envelope) is maximum. Press the two tracking control buttons (up down) and check that the FM envelope becomes as shown in Fig. 3-16.

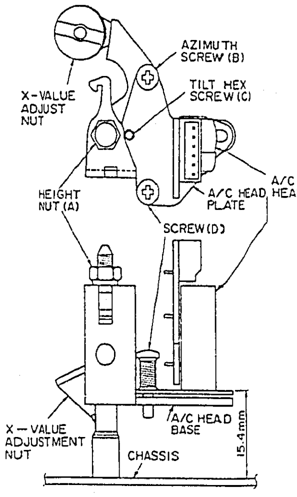


Fig. 3-14

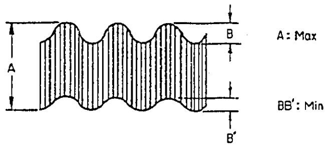


Fig. 3-15

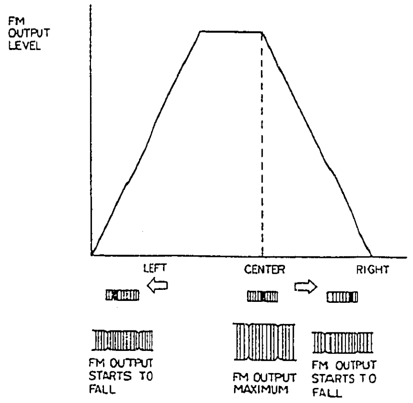


Fig. 3-16

4-8. Adjustment After Replacing the Cylinder (Fig. 3-17)

When the cylinder is replaced, the relative height with respect to the guide roller or the x-value, etc. drifts (this drift is small when the cylinder is replaced correctly). Therefore, it is necessary to readjust the tape transport system and servo system. Perform checks and adjustments by the following steps.

Note: Press the two tracking control buttons (UP and DOWN) simultaneously to set the tracking to center in this model.

TEST EQUIPMENT/JIG	*STATE OF VCR*	*TEST POINTS*	*ADJUSTMENT POINTS*
·Blank Tape ·Alignment Tape(MH-1) ·Oscilloscope		·TP204 MAIN ·TP207(SW30Hz) MAIN	

ADJUSTMENT PROCEDURE:

1) Load a blank tape and set the unit to the play mode.
2) Check that no curling or creasing of the tape occurs around the guide rollers. If curling or creasing of the tape occurs, fine adjust the height of the guide rollers.
3) Connect the oscilloscope to TP204.
4) Trigger the oscilloscope to TP207(SW30Hz).
5) Load a alignment tape and playback a monoscope signal.
6) Press the tracking control buttons (UP/DOWN) for maximum FM envelope amplitude at center of envelope.
7) Adjust scope vertical gain control so that maximum envelope amplitude is 4 divisions.
8) Press either tracking control button (up and down) so that maximum amplitude is 3 divisions.
9) Confirm that the minimum amplitude is set to 1.6 divisions or more at this time.
10) If the specifications in steps 8) and 9) cannot be confirmed, adjust the height of the supply and take-up guide rollers so that specifications are satisfied.
11) Press the two tracking control buttons (UP and DOWN) simultaneously and adjust the x-value for maximum FM envelope amplitude.
12) Perform the following electrical adjustments referring to CHAPTER 4.
    - ·Head switching Point Adjustment
    - ·Record Chroma and Luminance Level Adjustment

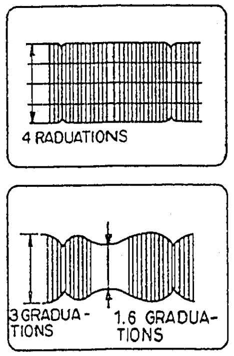
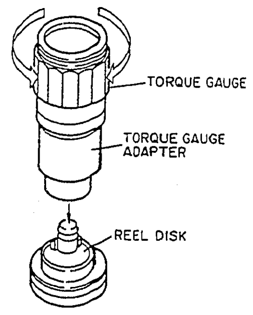


Fig. 3-17

5. CHECK THE TORQUE (Fig. 3-18)

ITEM	VCR MODE	MEASURED REEL DISK	MEASUREMENT VALUE	REMARKS MEASUREMENT PROCEDURE:
Main Brake Torque	F. FWD to Stop	Supply	70 ~ 150 g-cm	 Fig. 3-18
	Rewind to Stop	Take-up	70 ~ 150 g-cm	
Take-up Torque	Play	Take-up	85 ~ 115 g-cm	
Fast Forward Torque	Fast Forward	Take-up	400g-cm or more	
Rewind Torque	Rewind	Supply	400g-cm or more	
Slack Removal Torque	Play to Stop	Supply	90 ~ 160 g-cm	
Back Tension Torque	Fast Forward	Supply	3 ~ 10 g-cm	
	Rewind	Take-up		

CHAPTER 4 ELECTRICAL ADJUSTMENT

1. CONNECTIONS FOR ADJUSTMENT

·Remove the components shown in the table below beforhand, referring to the CHAPTER 2 DISASSEMBLY.

ORDER FOR REMOVING PARTS	*ITEM No.*
·Left Case	1-1
·Front Cover	1-2

Notes:

1 Be sure to connect the EVF when performing this adjustment. If it is not connected, no characters will appear on the monitor screen and no power is supplied.

2 Use s personal computer for the Auto Iris Control, Iris Calibration, Blue Matrix, White Balance and Chroma Gain adjustments in the camera section.

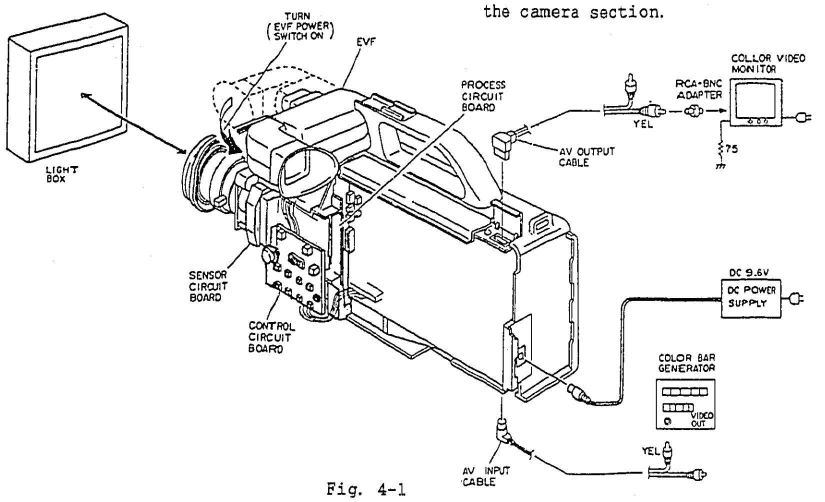


Fig. 4-1

2. CAMERA SECTION ADJUSTMENT

2-1. CIRCUIT BOARD LOCATIONS

1. Auto Focus Circuit Board
2. Sensor Circuit Board
3. Control Circuit Board
4. Process Circuit Board

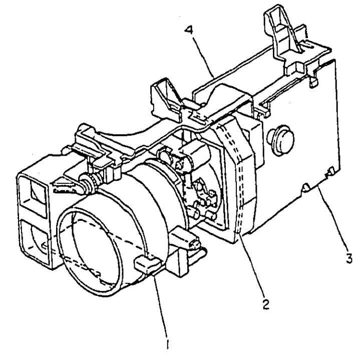


Fig. 4-2

2-2. TEST EQUIPMENT AND CHARTS NECESSARY FOR ADJUSTMENT

·Test Equipment
- Oscilloscope:(dual trace)
- (Vectorscope)
- Frequency Counter
- Digital Voltmeter (DVM)
- Color Video Monitor

·Charts, etc.
- Gray Scale Chart
- Color Bar Chart
- Resolution Chart
- Backfocus Adjustment Chart
- Light Box(3100 K)
- Personal Computer
- DSP jig
- DC Power Supply(5V)
- Light Balancing Filter (C12)
- Backfocus Adjustment Driver

2-3. ADJUSTMENT CONDITIONS

1) Check that the VCR section has been adjusted correctly before adjusting the camera section.
2) Connect this unit, a power supply and a color video monitor as shown in Fig. 4-1.
3) Place the chart (light box) 2 meters away from the camera (lens surface) when otherwise not specified.
4) Point the camera at the chart to full the video period when otherwise not specified.
5) Use the 10:1 probe of the oscilloscope when otherwise not specified.
6) When "Trigger the oscilloscope internally" is specified, set the time base of the oscilloscope to 10μs/div.
7) When using the video out (AV OUT) to perform adjustment, be sure to terminate the AV output jack with 75 ohm.

2-4. PRESET POSITION OF SWITCHES AND CONTROLS DURING ADJUSTMENT

POWER switch ...... "CAMERA" position
EVF POWER switch .. Operation Position
IRIS control ...... Center (Detent) position
FULL AUTO switch .. "AUTO" position
NEGA/POS switch .... "POS" position

2-5. LIST OF CHARTS FOR CAMERA ADJUSTMENT

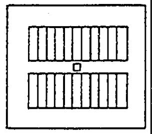
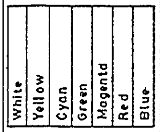
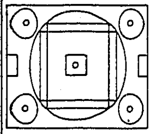
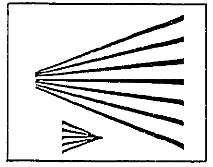
Gray Scale Chart	Color Bar Chart	Resolution Chart
		
Backfocus Adjustment Chart		

Table 4-1

-MEMO-

2-6. CAMERA ADJUSTMENT

1) Subcarrier Frequency Confirmation (Fig. 4-52)

Note: 1. Basically, it is not necessary to adjust the subcarrier frequency. Be sure to check the frequency before adjustment, and adjust it only when it is drifted.
2. Be careful when applying an adjustment driver to CT101 because the stray capacitance of the driver may vary the frequency. Use a non-metallic adjustment tool.

PURPOSE	This adjustment sets the frequency of the chroma subcarrier.					
TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
·TP101	PC	·CT101 (Fo ADJ)	PC		·Frequency Counter	·14.31818MHz ± 20Hz

ADJUSTMENT PROCEDURE:
1. Connect the frequency counter to TP101.
2. Confirm that the frequency is 14.31818MHz ± 20Hz.
   If the frequency is drifted, adjust the Fo CT101 for 14.31818MHz ± 20Hz.

2) Sensor Drive Pulse Frequency Confirmation (Fig. 4-51)

Note: 1. Basically, it is not necessary to adjust the sensor drive pulse frequency. Be sure to check the voltage before adjustment, and adjust it only when it is drifted.
2. Be careful when applying an adjustment driver to CT1 because the stray capacitance of the driver may vary the voltage. Use a non-metallic adjustment tool.

PURPOSE	This adjustment sets the frequency of the drive pulse.					
TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
·TP1 (on IC003)	SP	·CT1 (on IC003) (SENSOR DRIVE Fo)	SP		·DVM	·3.0V ± 0.1V

ADJUSTMENT PROCEDURE:
1. Connect the DVM to TP1 (on IC003).
2. Confirm that the voltage is 3.0V ± 0.1V.
   If the voltage is drifted, adjust the CT1 on IC003 for 3.0V ± 0.1V.

3) Backfocus Adjustment (Fig. 4-3)

PURPOSE	This adjustment assures proper focus tracking throughout the zoom range.					
TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
		Relay Lens		·Position the camera section 2 meters from the backfocus chart and illuminated the object with approx. 100 lux	·Backfocus Adj. Driver ·Backfocus Adj. Chart ·Color Video Monitor	Same value between real distance and index on the ring

ADJUSTMENT PROCEDURE:
1. Set the FULL AUTO switch to MAN position.
2. Set the zoom ring to the wide angle position and the focus ring to the 2 meter.
3. Loosen the hexagonal screw.
4. Insert the backfocus adjustment driver into the backfocus adjustment point and turn it to the left and right to optimum the focus.
5. Set the zoom ring to the telephoto end and confirm that the chart is in focus. If it is not in focus, return the zoom ring to the wide angle end and readjust step 4.
6. Confirm that the chart is approximately in focus at both the wide angle and telephoto ends with the focus ring set to the 2 meters.
7. Set the FULL AUTO switch to AUTO position.

Note: After adjustment is completed, tighten the hexagonal screw with the backfocus adjustment driver inserted into the adjustment point (holding the backfocus adjustment driver by hand) so that the adjusted position will not drift.

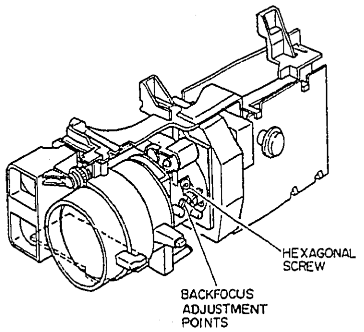


Fig. 4-3

4) Sensor Sub Voltage Adjustment (Fig. 4-4)

PURPOSE	This adjustment eliminates "vertical blooming".					
TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
·Video Monitor		·RT1 (on IC003) (SENSOR SUB VOLTAGE)	SP	·Point the camera at a 40W to 60W incandescent lump 1 meter away.	·Color Video Monitor	

(Continued)

ADJUSTMENT PROCEDURE:

1) Turn the RT1 on IC003 fully counter clockwise and then turn it gradually clockwise to adjust so that the band of blooming appearing in the vertical direction of the monitor screen just disappears.

Note: Stop RT1 where blooming disappears and be careful not to turn it too far.

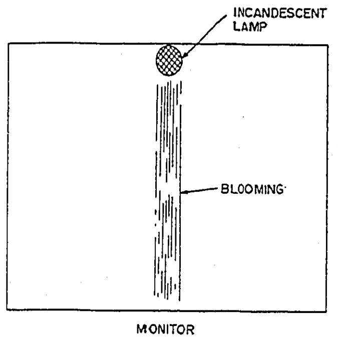


Fig. 4-4

5) Preset Digital Signal Processing (DSP) Adjustment (Fig. 4-5)

Note: Connect the personal computer and set it initially as follows for the Auto Iris Control, Iris Calibration, Blue Matrix, White Balance and Chroma Gain adjustments.

TEST POINTS		ADJUST POINTS		CONDITION	EQUIPMENT/JIG	SPECIFICATION
·TP901 ·TP902	MAIN MAIN				·DSP Jig ·Personal Computer ·DC Power Supply (5.0V ± 0.1V)	

ADJUSTMENT PROCEDURE:

1. Connect the yellow lead wire on the DSP jig and TP901.
2. Connect the white lead wire on the DSP jig and TP902.
3. Connect the black lead wire on the DSP jig and GND.
4. Connect the red lead wire on the DSP jig and DC power supply (5.0V ± 0.1V).
5. Supply power to the unit.
6. Connect the DSP jig and personal computer and then start the personal computer.

Note: Refer to the instrument manual of each personal computer for its start.

7. Input MAP_IBM
8. The following MAIN MENU appears. Input the parameter to be executed.

```
▨▨▨▨▨▨ MAIN MENU ▨▨▨▨▨▨

    [A]   INITIALIZE EEPROM
    [B]   ADJUSTMENT
    [ESC] END

  Please select [A] or[B] or [ESC]
```

[A] INITIALIZE EEPROM: Rewrites the data of the EEPROM. Select this parameter only when the EEPROM (IC107) is replaced.

[B] ADJUSTMENT: Executes the adjustment program.

[ESC] END: STOP

9. When [1] INITIALIZE EEPROM is input:
   1) The INITIAL SETTING menu appears. Input the model or parameter to be executed.

```
▨▨▨▨▨▨ INITIAL SETTING ▨▨▨▨▨▨

      [1]   VM-4400A
      [2]   XXXXXXXX
      [3]   XXXXXXXX
      [4]   XXXXXXXX
      [5]   XXXXXXXX
      [P]   NEXT SELECTION
      [ESC] RETURN TO MAIN MENU

   Please select the type of the set.
   Hit [1]-[5] or [P] or [ESC]
```

[1]-[5]: Selects a model.
[P] Switches the model menu page
[ESC]: Returns to MAIN MENU.

Note: When a key other then those displayed in the menu is pressed, the following display appears.

```
 Cannot find the DATA FILE.
▨▨▨▨ HIT ANY KEY ▨▨▨▨
```

⟨Continued⟩

2) When one of the [1]-[5] keys is pressed, the following display appears.

```
 NOW INITIAL SETTING          →       COMPLETED INITIAL SETTING !!
Please wait a moment.       (Next)    ▨▨▨▨ HIT ANY KEY ▨▨▨▨
```

3) Press any key. The INITIAL SETTING menu in step 1) is display.
4) Press ESC to return to the MAIN MENU.

10. When [2] ADJUSTMENT is input:
   1) The ADJUSTMENT MENU appears. Input the parameter to be executed.

```
▨▨▨▨▨▨ ADJUSTMENT MENU ▨▨▨▨▨▨

      [1]   AUTO IRIS CONTROL
      [2]   IRIS CALIBRATION
      [3]   BLUE MATRIX
      [4]   WHITE BALANCE
      [5]   CHROMA GAIN
      [ESC] RETURN TO MAIN MENU

   Please select[1]-[5] or [ESC]
```

[1]-[5]: Selects an adjustment item
[ESC]: Returns to MAIN MENU.

11. Now, the connection and initial setting of the personal computer is completed. Select the adjustment items and then perform each adjustment, referring to the procedures.

12. Perform the following procedure to complete adjustment.
   1) Display the ADJUSTMENT MENU and press ESC.
   2) The MAIN MENU appears. Press ESC again.
   3) Press ESC when the main menu is displayed, to end the program. (Check DOS PROMPT)
   4) Remove the floppy disk with the adjustment program.

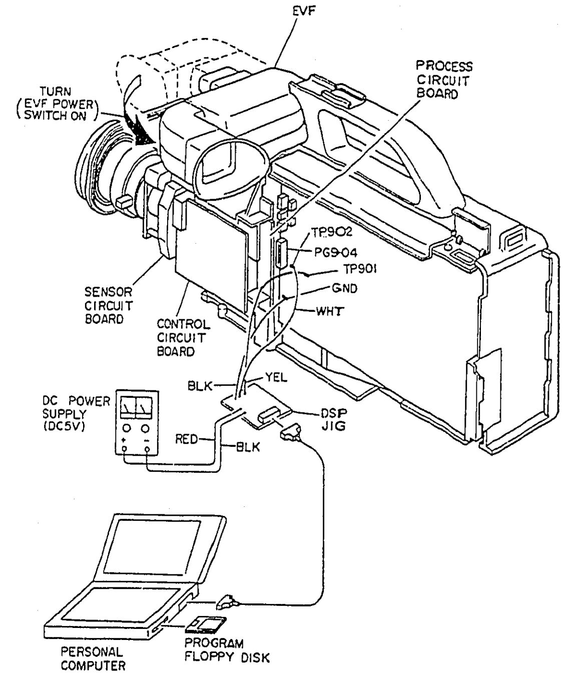


Fig. 4-5

6) Auto Iris Control Level Adjustment (Fig. 4-5)

Notes:1. Since this adjustment is executed automatically inside the DSP microprocessor, there are no parts to be adjusted.
2. If ERROR appears during adjustment, display the ADJUSTMENT MENU and check the cause of error.

PURPOSE	This adjustment sets the balance point of the auto iris control. If this adjustment is incorrect, the picture is extremely bright or dark.

TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
		·Aim the light box without chart	·DSP Jig ·Oscilloscope	

ADJUSTMENT PROCEDURE:
1. Connect the oscilloscope to video out (A/V OUT).
2. Trigger the oscilloscope internally.
3. Input 1(AUTO IRIS CONTROL) in the ADJUSTMENT MENU.
4. The display showing the adjustment being done appears.

```
AUTO IRIS CONTROL ADJUSTING
   Please wait a moment.
```

5. When the adjustment is ended, the display changes.

· Adjustment completed.

```
VIDEO LEVEL DATA WRITING TO EEPROM
```

· Adjustment cannot be executed.

Example A)

```
           ERROR !!

MAY BE DEVICE ON THE SET IS BROKEN !
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

Example B)

```
           ERROR !!

     BAD LIGHT CONDITION !
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

Example C)

```
           ERROR !!

  IRIS HALL DEVICE BE DEFECTIVE !
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

6. When the EEPROM data is rewritten, the display changes.

·Rewriting completed

```
     COMPLETED WRITING EEPROM
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

·Rewriting cannot be executed.

```
             ERROR !!

       CAN'T WRITE TO EEPROM
Check the wiring or change the EEPROM
 ▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

7. Press any key to return to the ADJUSTMENT MENU

7) Iris Calibration Adjustment (Fig. 4-5)

Notes:1. Since this adjustment is executed automatically inside the DSP microprocessor, there are no parts to be adjusted.
2. If ERROR appears during adjustment, display the ADJUSTMENT MENU and check the cause of error.

PURPOSE	To make the F value detection precise.

TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
		·Aim the light box without chart	·DSP Jig ·Oscilloscope	

ADJUSTMENT PROCEDURE:
1. Connect the oscilloscope to video out (A/V OUT).
2. Trigger the oscilloscope internally.

⟨Continued⟩

3. Input 2(IRIS CALIBRATION) in the ADJUSTMENT MENU.
4. The display showing adjustment being done appears.

```
IRIS CALIBRATION ADJUSTING
   Please wait a moment.
```

5. When the adjustment is ended, the display changes.

·Adjustment completed.

```
HALL DATA WRITING TO EEPROM
```

·Adjustment cannot be executed.

Example A)

```
           ERROR !!

MAY BE DEVICE ON THE SET IS BROKEN !
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

Example B)

```
           ERROR !!

     BAD LIGHT CONDITION !
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

Example C)

```
           ERROR !!

  IRIS HALL DEVICE BE DEFECTIVE !
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

6. When the EEPROM data is rewritten, the display changes.

·Rewriting completed

```
     COMPLETED WRITING EEPROM
▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

·Rewriting cannot be executed.

```
             ERROR !!

       CAN'T WRITE TO EEPROM
Check the writing or change the EEPROM
 ▒▒▒▒▒▒▒▒ HIT ANY KEY ▒▒▒▒▒▒▒▒
```

7. Press any key to return to the ADJUSTMENT MENU

8) Blue Matrix Adjustment (Figs. 4-5, 4-6)

Note: If ERROR appears during adjustment, display the ADJUSTMENT MENU and check the cause of error.

PURPOSE	This adjustment corrects for unevenness in tint.

TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·U key ·D key (Personal computer keyboard)	·Aim the color bar chart	·Oscilloscope	

ADJUSTMENT PROCEDURE:
1. Set the FULL AUTO switch to the MAN position.
2. Connect the oscilloscope to video out (A/V OUT).
3. Trigger the oscilloscope internally.
4. Input 3(BLUE MATRIX) in the ADJUSTMENT MENU.
5. The adjustment mode setting display appears.

```
BLUE MATRIX ADJUST MODE SETTING
     Please wait a moment
```

6. The adjustment display appears.

```
     BLUE MATRIX ADJUSTMENT

[U]      UP
[D]      DOWN
[ENTER]  RETURN TO MENU
```

7. Press the D key to minimize the yellow amplitude, and then press the U key to adjust the yellow amplitude so its ration to the blue amplitude is 1:3.

⟨Continued⟩

8. Press ENTER to end the Blue matrix adjustment.
9. The adjustment is ended and the display changes.

BLUE MATRIX DATA WRITING TO EEPROM

10. When the EEPROM data is rewritten, the display changes.

·Rewriting complete

COMPLETED WRITING EEPROM
※※※※※※※※※※ HIT ANY KEY ※※※※※※※※※※

·Rewriting cannot be executed.

ERROR !!

CAN'T WRITE TO EEPROM
Check the writing or change the EEPROM
※※※※※※※※※※ HIT ANY KEY ※※※※※※※※※※

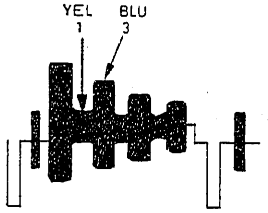


Fig. 4-6

11. Set the FULL AUTO switch to the AUTO position.
12. Press any key to return to the ADJUSTMENT MENU

9) White Balance Adjustment (Figs. 4-5, 4-7)

Note: If ERROR appears during adjustment, display the ADJUSTMENT MENU and check cause of error.

PURPOSE	This procedure sets the correct red and blue signal levels for proper white balance circuit operation.			
TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·U key ·D key ·R key ·L key (Personal computer keyboard)	·Attach the C12 Filter ·Aim the gray scale chart	·Oscilloscope	

ADJUSTMENT PROCEDURE:
1. Connect the oscilloscope to video out (AV OUT).
2. Input 4(WHITE BALANCE) in the ADJUSTMENT MENU.
3. The adjustment mode setting display appears.

WHITE BALANCE ADJUST MODE SETTING
Please wait a moment

4. The adjustment display appears.

WHITE BALANCE ADJUSTMENT

[U] RED-GAIN UP
[D] RED-GAIN DOWN
[R] BLUE-GAIN UP
[L] BLUE-GAIN DOWN
[ENTER] RETURN TO MENU

5. Press the U ,D ,R and L keys to adjust, minimize carrier in the waveform.
6. Press ENTER to end the White Balance adjustment.
7. The adjustment is ended and the display changes.

WHITE BALANCE DATA WRITING TO EEPROM

8. When the EEPROM data is rewritten, the display changes.

·Rewriting completed

COMPLETED WRITING EEPROM
※※※※※※※※※※ HIT ANY KEY ※※※※※※※※※※

⟨Continued⟩

·Rewriting cannot be executed.

ERROR !!

CAN'T WRITE TO EEPROM
Check the writing or change the EEPROM
※※※※※※※※※※ HIT ANY KEY ※※※※※※※※※※

9. Press any key to return to the ADJUSTMENT MENU

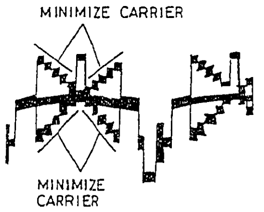


Fig. 4-7

10) Chroma Gain Adjustment (Figs. 4-5, 4-8)

Note: If ERROR appears during adjustment, display the ADJUSTMENT MENU and check cause of error.

PURPOSE	This adjustment sets the chroma level.			
TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·U key ·D key (Personal computer keyboard)	·Attach the C12 Filter ·Aim the color bar chart	·Oscilloscope	

ADJUSTMENT PROCEDURE:
1. Connect the oscilloscope to video out (AV OUT).
2. Input 5(CHROMA GAIN) in the ADJUSTMENT MENU.
3. The adjustment mode setting display appears.

CHROMA GAIN ADJUST MODE SETTING
Please wait a moment

4. The adjustment display appears.

CHROMA GAIN ADJUSTMENT

[U] UP
[D] DOWN
[ENTER] RETURN TO MENU

5. Press the U and D keys to adjust so that red level of the waveform is 570mV ± 60mV.
6. Press ENTER to end the Chroma Gain adjustment.
7. The adjustment is ended and the display changes.

Chroma Gain DATA WRITING TO EEPROM

8. When the EEPROM data is rewritten, the display changes.

·Rewriting completed

COMPLETED WRITING EEPROM
※※※※※※※※※※ HIT ANY KEY ※※※※※※※※※※

·Rewriting cannot be executed.

ERROR !!

CAN'T WRITE TO EEPROM
Check the writing or change the EEPROM
※※※※※※※※※※ HIT ANY KEY ※※※※※※※※※※

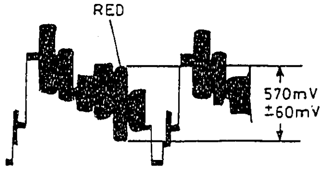


Fig. 4-8

9. Check that the tint of the chart and the tint of the picture are approximately matched at this time.
10. Press any key to return to the ADJUSTMENT MENU

2-7. ELECTRONIC VIEWFINDER (EVF) ADJUSTMENT

1) EVF Focus Adjustment (Fig. 4-53)

PURPOSE	This control adjusts for optimum focus of the electronic viewfinder picture.				
TEST POINTS	*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·RT803 (FOCUS)	EVF	·Aim the resolution chart	·EVF Display	

ADJUSTMENT PROCEDURE:
1. Adjust RT803 so that the EVF picture is clear.

2) Deflection Yoke Position Adjustment (Fig. 4-9)

PURPOSE	This adjustment procedure eliminates picture tilt on the EVF display.			
TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·Deflection Yoke	·Aim the resolution chart	·EVF Display	

ADJUSTMENT PROCEDURE:
1. Align the camera with the resolution chart making sure that both the camera and the chart are on the same plane.
2. Loosen the deflection yoke nut.
3. Turn the deflection yoke so that the EVF picture (chart) is horizontal, matching the edges of the CRT.

Note: After adjustment is completed, tighten the deflection yoke nut.

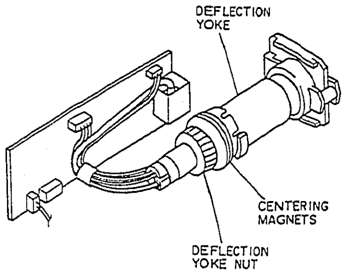


Fig. 4-9

3) EVF Centering Adjustment (Fig. 4-9)

PURPOSE	This adjustment centers the image observed by the camera in the EVF display.			
TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·Centering Magnets	·Aim the resolution chart	·EVF Display	

ADJUSTMENT PROCEDURE:
1. Remove the locking paint from the centering magnet.
2. Adjust the centering magnets until the center of the picture viewed by the camera is positioned in the center of the EVF display.

Note: After adjustment is completed, fix the centering magnets with lock print.

4) EVF Vertical Size Adjustment (Fig. 4-53)

PURPOSE	This adjustment determines the vertical size of the image appearing in the EVF display.				
TEST POINTS	*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·RT802 (V. SIZE)	EVF	·Aim the resolution chart	·EVF Display	

ADJUSTMENT PROCEDURE:
1. Adjust RT802 so that the top and bottom edges of the chart match the top and edges of the CRT.

5) EVF Brightness Adjustment (Fig. 4-53)

PURPOSE	This adjustment sets the brightness of the picture in the EVF display.				
TEST POINTS	*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·RT805 (BRIGHT)	EVF	·Aim the resolution chart	·EVF Display	

ADJUSTMENT PROCEDURE:
1. Adjust RT805 to optimize the EVF picture.

2-8. AUTO FOCUS ADJUSTMENT (Fig. 4-10)

1) AUTO FOCUS Sensor Position Adjustment

Note: Perform this adjustment while all cases assembled.

PURPOSE	This adjustment set the autofocus sensor position adjustment.			
TEST POINTS	*ADJUST POINTS*	*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
	·Sensor Adjustment Screw	·Aim the backfocus adjustment chart	·Color Video Monitor	

ADJUSTMENT PROCEDURE:

1. Remove the grip lid.
2. Place the FULL AUTO switch in the AUTO position.
3. Position the camera two (2) meters from the backfocus chart and illuminate the object with approximately 100 lux.
4. Set the zoom ring to the telephoto position.
5. Turn the Sensor Adjustment Screw so that the index on the focus ring is two (2) meters.
6. Operate the autofocus from the near end to the infinity end and check that the chart is in focus with the index at two (2) meters.
7. Attach the grip lid to the right case.

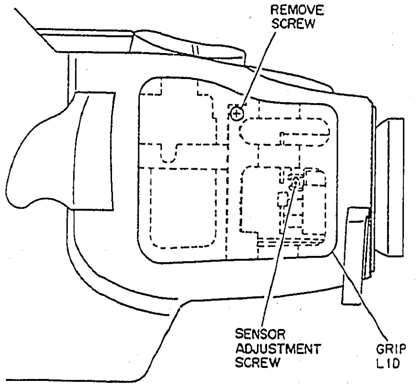

REMOVE SCREW
SENSOR ADJUSTMENT SCREW
GRIP LID

Fig. 4-10

2-9. adjustment which can be done using a vectorscope

Notes:1 Use the video output (A/V OUT) as the test point for all adjustments and terminate the vectorscope with 75 ohms.

2 Complete "5) Preset Digital Signal Processing (DSP) Adjustment" before performing the following adjustments.

ITEM No.	*NAME OF ADJUSTMENT*	*SUBJECT*	*ADJUSTMENT POINT*	*PROCEDURE*	*Fig. No.*
9)	White Balance Adjustment	·Attach the C12 filter ·Aim the gray scale chart	U, D, R, L key (Personal computer keyboard)	1. Input 4 MAIN MENU. 2. Press the U, D, R and L keys to adjust so the bright spot comes to the center.	4-11
10)	Chroma Gain Adjustment	·Attach the C12 filter ·Aim the color bar chart	U, D key (Personal computer keyboard)	1. Input 4 MAIN MENU. 2. Press the U and D keys to adjust so the red vector is 200% ± 20% of the burst level. 3. Check that the tint of the chart and the tint of the picture are approximately matched at this time.	4-12

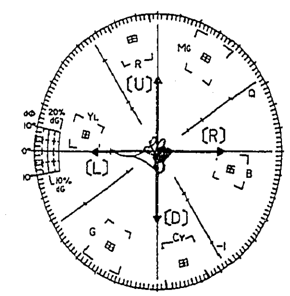

(U)
(R)
(L)
(D)
R
MG
YL
B
G
CY
Q
I

Fig. 4-11

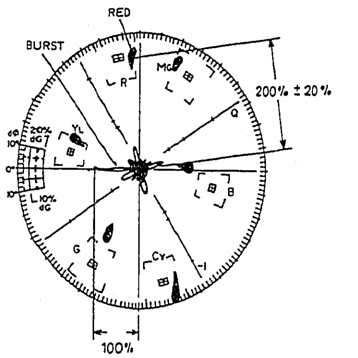

RED
BURST
200% ± 20%
R
MG
YL
B
G
CY
Q
I
100%

Fig. 4-12

2-10. ADJUSTMENT COMPONENTS LOCATIONS

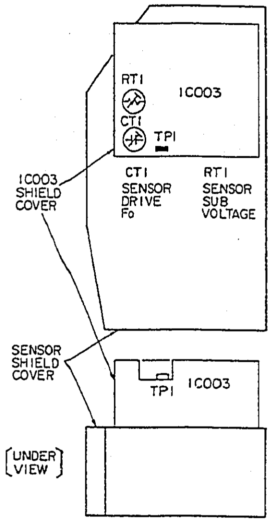

RT1
IC003
CT1
TP1
IC003 SHIELD COVER
CT1 SENSOR DRIVE Fo
RT1 SENSOR SUB VOLTAGE
SENSOR SHIELD COVER
TP1
IC003
UNDER VIEW

Fig. 4-51 Sensor (SP) Circuit Board (Solder Side)

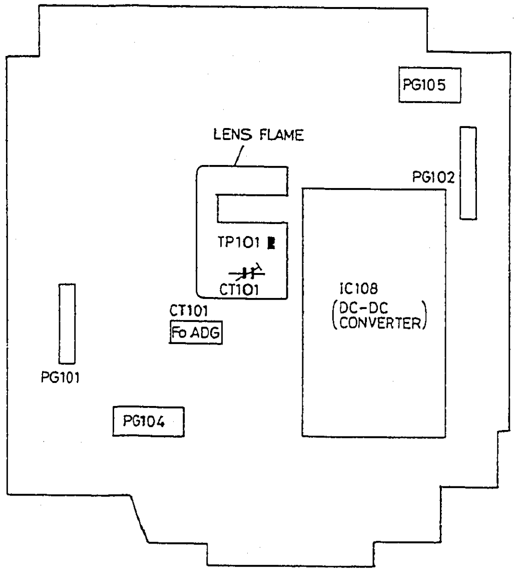

PG105
LENS FLAME
PG102
TP101
CT101
CT101
Fo ADG
IC108 (DC-DC CONVERTER)
PG101
PG104

Fig. 4-52 Process (PC) Circuit Board (Componet Side)

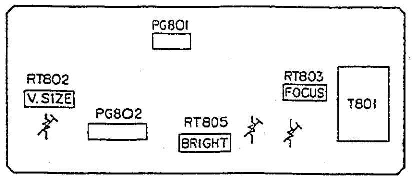

PG801
RT802
V.SIZE
PG802
RT805
BRIGHT
RT803
FOCUS
T801

Fig. 4-53 Electronic Viewfinder (EVF) Circuit Board (Componet Side)

3. VCR SECTION ADJUSTMENT

3-1. CIRCUIT BOARD LOCATIONS

1. Main Circuit Board
2. Take-up Sensor Circuit Board

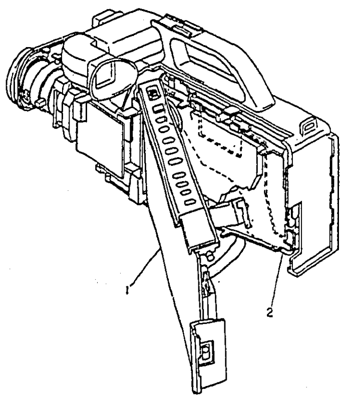


Fig. 4-101

3-2. TEST EQUIPMENT AND ALIGNMENT TAPES NECESSARY FOR ADJUSTMENT

- Test Equipment
  - Oscilloscope (dual trace)
  - Millivoltmeter
  - Color Video Monitor
  - Color Bar Generator
- Alignment Tapes etc.
  - Alignment Tape (MH-1)
  - Blank Tape

3-3. ADJUSTMENT CONDITIONS

1) Check that the camera section has been adjusted correctly before adjusting the VCR section.

2) Connect this unit, a power supply and a color video monitor as shown in Fig. 4-1.

3) Use the 10:1 probe of the oscilloscope when otherwise not specified.

4) When using the video out (AV OUT) to perform adjustment, be sure to terminate the AV output jack with 75 ohm.

5) When "REC" mode is specified, set the POWER switch to CAMERA position and press the REC PAUSE button or PAUSE button on the function switchs.

6) When "TRACKING PRESET" position is specified, press the two (2) TRACKING control buttons (up and down) simultaneously.

3-4. PRESET POSITION OF SWITCHES AND CONTROLS DURING ADJUSTMENT

POWER switch .... "VCR" position
EVF POWER switch .... Operation Position
Note: Or, short pins 1 and 2 of PG909
TRACKING .... Preset position

3-5. SERVO SECTION

1) Head Switching Point Adjustment (Figs. 4-102, 4-151)

PURPOSE The pulse generator shifter determines the video head switching point during playback. Misadjustment of pulse generator shifter may cause head switching noise in the picture and/or vertical instability.

TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
·Video Out (A/V OUT) ·TP207 (SW30HZ)	MAIN MAIN	·RT601 (PG SHIFTER)	MAIN	·Power switch : VCR ·Playback the alignment tape	·Oscilloscope ·Alignment Tape (MH-1:Color Bar)	·6.5H ± 0.5H

ADJUSTMENT PROCEDURE:

1. Connect the oscilloscope terminated with 75 ohms to video out. (0.5V/div.; 50μs/div.)
2. Trigger the oscilloscope at SW30Hz.
3. Set the oscilloscope to (-) slope and adjust the RT601 so that the trailing edge of the SW30Hz signal is placed 6.5H ± 0.5H (horizontal) lines before the start of CH-1 vertical sync.
4. Set the oscilloscope to (+) slope and confirm the leading edge of the SW30Hz signal is 6.5H ± 0.5H (horizontal) lines before the start of CH-2 vertical sync.

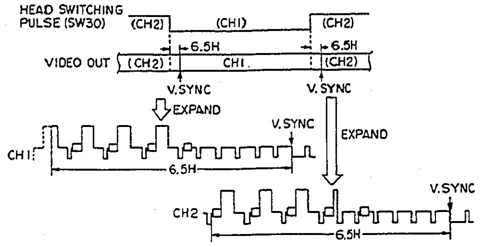

HEAD SWITCHING PULSE (SW30)
(CH2)
(CH1)
(CH2)
6.5H
6.5H
VIDEO OUT
(CH2)
CH1
(CH2)
V.SYNC
V.SYNC
EXPAND
V.SYNC
EXPAND
CH1
6.5H
V.SYNC
CH2
6.5H

Fig. 4-102

3-6. LUMA/CHROMA SECTION

1) Record Chroma and Luminance Level Adjustment (Figs. 4-103, 4-104, 4-151)

PURPOSE Optimum record color and luminance level is regulated by this adjustment. If the record chroma level is too high, diamond beats can be seen in the screen. If the level is too low, the color is degraded. If the record luma level is too high, video may overload. If the level is too low, the S/N ratio deteriorates.

TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
·TP205 ·TP207 (SW30HZ)	MAIN MAIN	·RT202 (REC CHROMA LEVEL) ·RT201 (REC LUMA LEVEL)	MAIN MAIN	·Power switch : CAMERA ·Record mode ·Apply a color bar signal (1Vp-p) to the A/V INPUT jack	·Color Bar Generator ·Oscilloscope ·Blank Tape	·REC CHROMA LEVEL bust level 50mV ± 5mV ·REC LUMA LEVEL sync level 210mV ± 10mV

ADJUSTMENT PROCEDURE:

1. Connect the oscilloscope terminated with 75 ohms to TP205.
2. Trigger the oscilloscope at SW 30Hz.
3. Adjust the RT201 to minimize the amplitude of the waveform.
4. Set the trigger switch of the oscilloscope to H. SYNC.
5. Adjust the RT202 so the burst level of waveform is set to 50mVp-p ± 5mV. (50mV/div.; 20μs/div.) (See Fig. 4-103)
6. Trigger the oscilloscope at SW 30Hz.
7. Adjust the RT201 so the sync level of the waveform is set to 210mVp-p ± 10mV. (50mV/div.; 2ms/div.) (See Fig. 4-104)

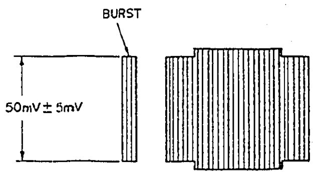

BURST
50mV ± 5mV

Fig. 4-103

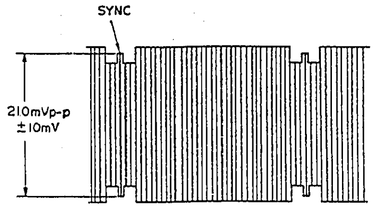

SYNC
210mVp-p
± 10mV

Fig. 4-104

2) 1H Delay Line Output Level Adjustment (Figs. 4-105, 4-151)

PURPOSE This adjustment makes the input and output levels of the CCD 1H delay line the same. If this adjustment is incomplete, switching noise is conspicuous when dropout is compensated.

TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
·TP203 ·TP207 (SW30HZ)	MAIN MAIN	·RT203 (1H DELAY LINE OUTPUT LEVEL)	MAIN	·Power switch : VÇR ·Playback the alignment tape	·Alignment Tape (MH-1:Color Bar) ·Oscilloscope	·Minimize Level

ADJUSTMENT PROCEDURE:

1. Connect the oscilloscope terminated with 75 ohms to TP203. (0.2V/div.; 2ms/div.)
2. Trigger the oscilloscope at SW 30HZ.
3. Adjust the RT203 to minimize level at the waveform.

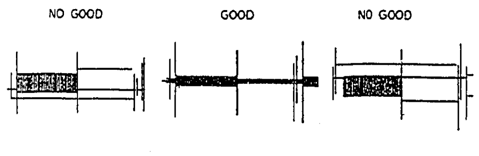

NO GOOD
GOOD
NO GOOD

Fig. 4-105

3-7. AUDIO SECTION

1) Audio bias Level Adjustment (Fig. 4-151)

Note: Perform this adjustment without applying an audio signal.

PURPOSE This adjustment optimize the audio record bias. When the audio record bias is too low, high frequencies are increased resulting in distortion. When the level is too high, high frequencies are attenuated.

TEST POINTS		*ADJUST POINTS*		*CONDITION*	*EQUIPMENT/JIG*	*SPECIFICATION*
·TP401 ·TP402 (GND)	MAIN MAIN	·RT401 (AUDIO BIAS LINE)	MAIN	·Power switch : CAMERA ·Record mode	·Millivoltmeter ·Blank Tape	·2.7mV ± 0.1mV

ADJUSTMENT PROCEDURE:

1. Connect the millivoltmeter to TP401.
2. Adjust the RT401 for 2.7mV ± 0.1mV.

3-8. ADJUSTMENT COMPONENTS LOCATIONS

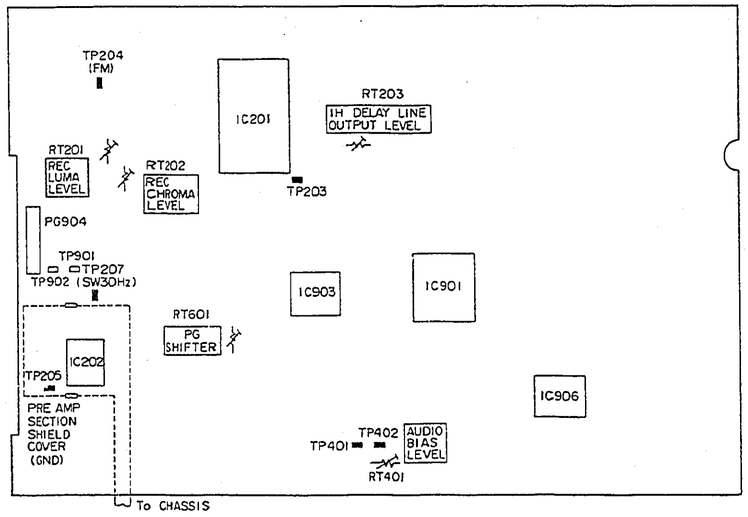

TP204
(FM)
IC201
RT203
1H DELAY LINE OUTPUT LEVEL
RT201
REC LUMA LEVEL
RT202
REC CHROMA LEVEL
TP203
PG904
TP901
TP207
TP902 (SW30Hz)
IC903
IC901
RT601
PG SHIFTER
IC202
TP205
IC906
PRE AMP SECTION SHIELD COVER (GND)
TP402
TP401
AUDIO BIAS LEVEL
RT401
To CHASSIS

Fig. 4-151 Main Circuit Board (Solder Side)

CHAPTER 5 SCHEMATIC DIAGRAM AND CIRCUIT BOARD DIAGRAMS
WHEN USING THIS SERVICE REFERENCE MATERIAL

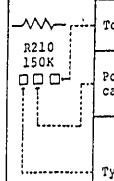
1. Markings in Schematic and Circuit Board Diagrams

(1) Parts with marks "■" attached to circuit numbers in the schematic and circuit board diagrams are discrete components.
(2) Parts with marks Ⓩ in the circuit board diagrams are leadless jumpers.

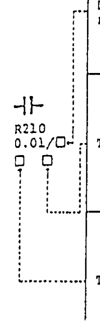
2. How to Read Abbreviations

Values, dielectric resistances (power capacitances), tolerances, grades of resistors (excluding variable resistors, etc.) and capacitors are indicated in the schematic diagrams using abbreviations. Collate these abbreviations and the following tables for reading abbreviations to replace parts correctly.

2-1. Resistors

	Value	No indication .... ohm K .... kohm
	Tolerance	No indication .... ±5% K .... ±10% M .... ±20%
	Power capacitance	No indication .... 1/8W (All capacitances other than 1/8W are indicated in schematic diagrams with W omitted)
	Type	No indication .. Carbon film fixed RC .... Carbon solid RW .... Power-type wire-wound solid RS .... Metal oxide film solid RN .... Metal film solid
Example R210 150K .... 150 kohm, carbon solid RC.1/2.K 1/2W, ±10%		

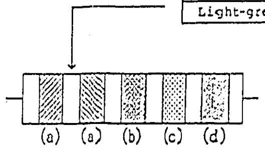
2-2. Capacitors

	Value	No indication .... μF P .... PF
	Dielectric resistance	No indication .... 50WV (All resistances other than 50WV and those of electrolytic capacitors are indicated with WV omitted.)
	Tolerances	No indication .... ±10% J .... ±5% M .... ±20% C .... ±0.25PF Z .... +80%/-20% (No indication with electrolytic capacitors (excluding tantalum and high stability electrolytic capacitors)
	Type	No indication .. Ceramic, general electrolytic (see circuit symbol to distinct from ceramic) MYL .... Mylar (Polyester film) STY .... Styrol TA .... Tantalum KU .... High stability electrolytic MP .... Metalized paper
Example C210 0.01/25 .... Mylar, 0.01μF, 25WV MYL.J ±5%		

3. How to Read Capacitance of Resistance-Type Capacitors and Coils

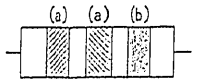
3-1 Capacitors

Color	Related voltage
Pink	25V
Light-green	50V



Color	Capacitance (a)	Multiplier (b)	Tolerance (c)	Characteristics (d)
Black	0	10^0	±20%	For temperature compensation
Brown	1	10^1		
Red	2	10^2		
Orange	3	10^3		
Yellow	4	10^4		
Green	5	10^5		
Blue	6	10^6		
Purple	7			
Gray	8		±30%	High permittivity type
White	9			For temperature compensation
Gold			±5%	
Silver			±10%	

3-2 Coils



4. Cautions on Use of MOS ICs

(1) MOS ICs are inserted in black foam for shipment. This foam is a conductor which short-circuits between the leads to prevent damage. Do not remove ICs from this foam during storage. Avoid removing ICs from this foam, placing them on plastic which is likely to be charged with static electricity or inserting them into styrol foam.
(2) High voltages may be applied during soldering caused by leakages from the soldering iron, so be sure to ground the tip of the soldering iron or use a low voltage soldering iron.
(3) The human body and clothes made of synthetic fibres or nylon gloves may be charged with several thousands volts of static electricity because of friction, so workers should be grounded.
(4) Be sure to ground measuring instruments such as oscilloscopes, VTVMs, etc. used for repairs.

5. Measure the voltages at each section with the negative side of power supply as a reference.

The voltages in the camera section are measured with the VTR in the record mode, and those in the VTR section are measured in the record and playback modes.
- * Voltages in ( ) are in the record mode.
- * One voltage value is common for recording and playback.

LEADLESS COMPONENT IDENTIFICATION

1. Leadless Transistors

The leadless transistor number is indicated by a code on its surface, using one letter, one letter and one numeral, two letters, two letters and one numeral, two numerals, two numerals and one letter, or three letters.

Letter	Transistor Number	Letter	Transistor Number
A	2SB709	H	2SA1036K
A(R)	2SB1218R(AR)	I	2SB792
A(S)	2SB766S(AS)	J	2SC2735
A(J)	2SB1000J(AJ)	K	2SA1036
B	2SC1621	K(P)	2SC2413P(KP)
B(J)	2SB1001J(BJ)	L	2SC2462
B(R)	2SC4081R(BR)	M	2SA1052
B(R)	2SC2412AR(BR)	N	2SC1653
B(S)	2SC2412KS(BS)	N(E)	2SD1306E(NE)
C	2SA1122	P	2SD814
C(L)	2SD999L(CL)	P(E)	2SA1171E(PE)
C(R)	2SB710R(CR)	Q	2SC2620
C(R)	2SC4097R(CR)	Q(O)	2SC2714O(QO)
C(R)	2SC2411R(CR)	R	2SC2618
C(Q)	2SC2411KQ(CQ)	S	2SA1121
D	2SC2463	S(Q)	2SC3082KQ(SQ)
D(L)	2SB798L(DL)	U	2SC2404
E	2SA1022	W	2SD602
F	2SC2619	Y	2SD601
F(S)	2SA1037KS(FS)	Y(R)	2SD1819R(YR)
F(R)	2SA1576R(FR)	Z	2SD874
-	- - - -	-	- - - -
AA(S)	2SD1757KS(AAS)	DB(R)	2SD1766R(DBR)
BC(R)	2SB1188R(BCR)	IR(D)	2SA1484D(IRD)
BF(R)	2SB1308R(BFR)		
-	- - - -	-	- - - -
1D(T)	2SD1328T(1DT)	1C(R)	2SB902R(1CR)
-	- - - -	-	- - - -
B(3)	2SC1621(3) (B3)	L(6)	MMBC1623(6) (L6)
C(7)	2SA811(7) (C7)	L(6)	2SC1623(6) (L6)
L(7)	2SC2812(7) (L7)	F(2)	2SC1009(2) (F2)
M(6)	2SA812(6) (M6)	M(6)	2SA1179(6) (M6)
N(4)	2SC1653(4) (N4)		
-	- - - -	-	- - - -
D(16)	2SC1622A(16)(D16)	R(25)	2SC3356(25)(R25)
R(35)	2SC3583(35)(R35)	R(45)	2SC3585(45)(R45)
Y(25)	NTM3906(25)(Y25)		
-	- - - -	-	- - - -
1(D)	2SC3127D(1D)		
-	- - - -	-	- - - -
S1	FMS1	S2	FMS2
T1	IMT1	W1	FMW1
W2	FMW2	W3	FMW3
X1	IMX1	Y1	FMY1
Y3	FMY3	Z1	IMZ1
Z2	IMZ2		
-	- - - -	-	- - - -
4R	XN1C301	5H	XN4501
5K	XN4401		
Digital Transistor	----------------------------		
04	DTC114TK	06	DTC144TK
13	DTA143EK	15	DTA124K
15(s)	DTA124EU	16	DTA144EK
16(s)	DTA144EU	23	DTC143EK
24	DTC114EK	24(s)	DTC114EU
25	DTC124K	25(s)	DTC124EU
26	DTC144K	26(s)	DTC144EU
33	DTA143XK	43	DTC143XK
52	DTA123YK	64	DTC114YK
-	- - - -	-	- - - -
6B	UN5112	8B	UN5212
-	- - - -	-	- - - -
F52	DTB123	G21	DTD113ZK
H03	DTC343TK	H27	DTC363EK
R31	FP1L2Q		
-	- - - -	-	- - - -
A1	FMA1	A2	FMA2
B2	IMB2	C2	FMC2
D2	IMD2	G1	FMG1
G2	FMG2	G5	FMG5
H2	IMH2		

Letter	Transistor Number	Letter	Transistor Number
FET	----------------------------		
G	2SK302	J	2SK208
K	2SK160	W	2SK322
X	2SK157	X(4)	2SK94(4)(X4)
X(17)	2SK425(17)(X17)		
Y	2SK197	Z	2SK217
-	- - - -	-	- - - -
XA	2SK980		
-	- - - -	-	- - - -
3	2SK620	3(O)	2SK621(O)(3O)
-	- - - -	-	- - - -
1M	2SA1052	1F	2SK321
1K	2SK316	2B	2SK374

* "(s)" in the above table shows a component with smaller size.

* Codes on the digital transistors show only the transistor numbers.

(1) Identification for two letters.
Use this code and the following chart for component identification.

Example:

Code	Number
CD	2SA1122D
LD	2SC2462D

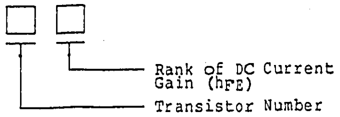


Fig.5-1 Leadless Transistor Code

(2) Identification for two types of one letter and one numeral.
Use this code and the following chart for component identification.

Letter	Transistor Number
L	2SC1623

Example:

Code	Number
L5	2SC1623(5)
L6	2SC1623(6)

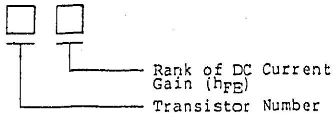
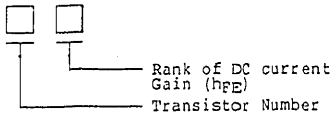


Fig.5-2 Leadless Transistor Code

Example:

Code	Number
1D	2SC3127D



Note: Codes S1, S2, T1, W1, W2, W3, X1, Y1, Y3, Z1 and Z2 show only the transistor numbers.

Fig.5-3 Leadless Transistor Code

(3) Identification for one numeral and two letters.
Use this code and the following chart for component identification.

Example:

Code	Number
1FQ	2SK321Q

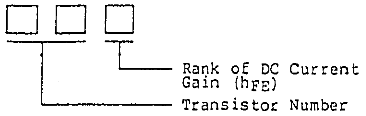


Fig.5-4 Leadless Transistor Code

(4) Identification for one letter and two numerals.
Use this coce and the following chart for component identification.

Example:

Code	Number
R25	2SC3356

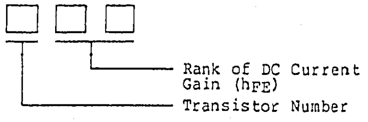


Fig. 5-5 Leadless Transistor Code

(5) Identification for two letters and one numeral.
Use this code and the following chart for component identification.

Example:

Code	Number
DV5	2SD596

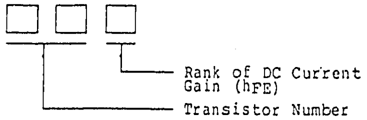


Fig. 5-6 Leadless Transistor Code

(6) Identification for three letters.
Use this code and the following chart for component identification.

Example:

Code	Number
AAS	2SD1757KS

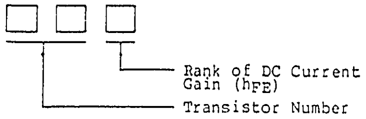


Fig. 5-7 Leadless Transistor Code

2. Leadless Diodes

Leadless diode numbers are indicated by a code on the surface, using one letter and one numeral, two letters, two letters and one numeral, two numerals, two numerals and one letter, or three numerals.
Use this code and the following chart for component identification.

Code	Diode Number	Code	Diode Number
BE	1SV172		
MC	MA153	MC(s)	MA143
MH	MA151K	MH(s)	MA141K
MN	MA151WA	MN(s)	MA141WA
MO	MA152WA		
MT	MA151WK	MT(s)	MA141WK
MU	MA152WK		
-	- - - -	-	- - - -
M1D	MA160	M1P	MA714
M2A	MA122	S1A	1SR143
-	- - - -	-	- - - -
N	DAN202K	Z	DA106K
-	- - - -	-	- - - -
A3	1S2835	A5	1S2837
C1	HSM88S	C2	HSM276S
-	- - - -	-	- - - -
1A	MA110		
-	- - - -	-	- - - -
3.0L	MA3030L	4.3L	MA3043L
4.7M	MA3047M	5.1M	MA3051M
5.1L	MA3051L	5.6M	MA3056M
6.2L	MA3062L	6.8M	MA3068
6.8M	MA3068M	7.5H	MA3075H
7.5L	MA3075L	8.2M	MA3082M
9.1M	MA3091	9.1M	MA3091M
10L	MA3100L	56M	MA3056M
75L	MA3075L	82M	MA3082M
91M	MA3091M		
-	- - - -	-	- - - -
20	HZM6-B	27	RD2.7M-B
30	RD3.0M-B	51	RD5.1M-B2
56	RD5.6M-B	91	RD9.1M-B
-	- - - -	-	- - - -
102	RD10M-B2	122	RD12M-B2
163	RD16M-B3	182	RD18M-B2
271	RD2.7M-B	272	RD2.7M-B2
301	RD3.0M-B	362	RD3.6M-B2
391	RD3.9M-B1	512	RD5.1M-B2
561	RD5.6M-B	621	RD6.2M-B1
681	RD6.8M-B	683	RD6.8M-B3
911	RD9.1M-B		

* "(s)" in the above table shows a component with smaller size.

3. Leadless Resistors

The resistor value is indicated on the surface of the component, using a three-digit numbers, or one letter and one numeral.

(1) Identification for three digit numbers.
Read this code following the same procedure as when reading the color code on discrete resistors.

Example:

Code	Value
330	$33 \times 10^0 = 33$ ohms
561	$56 \times 10^1 = 560$ ohms
123	$12 \times 10^3 = 12$K ohms
1R2	$1 + 0.2 = 1.2$ ohms (R: Decimal point)

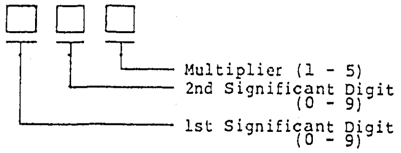


Fig. 5-8 Leadless Resistor Code

(2) Identification for one letter and one numeral.
Use this code and the following chart for component identification.

Letter	Value	Letter	Value	Letter	Value
A	1	J	2.2	S	4.7
C	1.2	L	2.7	U	5.6
E	1.5	N	3.3	W	6.8
G	1.8	Q	3.9	Y	8.2

Example:

Code	Value
A1	$1 \times 10^1 =$ 10 ohms
G2	$1.8 \times 10^2 =$ 180 ohms
L3	$2.7 \times 10^3 =$ 2700 ohms
S4	$4.7 \times 10^4 =$ 47K ohms
W5	$6.8 \times 10^5 =$ 680K ohms

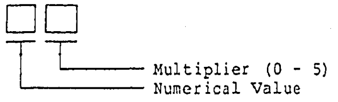
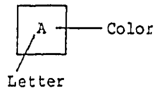


Fig. 5-9 Leadless Resistor Code

4. Leadless Capacitors

The capacitance value is indicated on the surface of the component, using body color and one letter, or one letter and one numeral.

(1) Identification for body color and one letter.



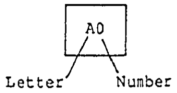
Body Color	Letter	Value
Red	A	1(PF)
	C	2
	E	3
	G	4
	J	5
	L	6
	N	7
	Q	8
	S	9
Black	A	10(PF)
	C	12
	E	15
	G	18
	J	22
	L	27
	N	33
	Q	39
	S	47
	U	56
	W	68
	Y	82

Body Color	Letter	Value
Blue	A	100(PF)
	C	120
	E	150
	G	180
	J	220
	L	270
	N	330
	Q	390
	S	470
	U	560
	W	680
	Y	820
White	A	0.001(μF)
	E	0.0015
	J	0.0022
	L	0.0027
	N	0.0033
	S	0.0047
	W	0.0068
Green	A	0.01(μF)
	E	0.015
	J	0.022
	N	0.033
	S	0.047
	U	0.056
	W	0.068
	Y	0.082
Yellow	A	0.1(μF)

Example:

Color	Code	Value
Red	A	1PF
Black	A	10PF

(2) Identification for one letter and one numeral.



Letter /Number	Value
A0	1(PF)
H0	2
M0	3
d0	4
f0	5
m0	6
n0	7
t0	8
y0	9
A1	10(PF)
C1	12
E1	15
G1	18
J1	22
L1	27
N1	33
Q1	39
S1	47
U1	56
W1	68
Y1	82

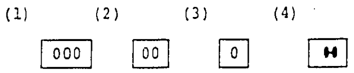
Letter /Number	Value
A2	100(PF)
C2	120
E2	150
G2	180
J2	220
L2	270
N2	330
Q2	390
S2	470
U2	560
W2	680
Y2	820
A3	0.001(μF)
E3	0.0015
J3	0.0022
N3	0.0033
S3	0.0047
W3	0.0068
A4	0.01(μF)
E4	0.015
J4	0.022
N4	0.033
S4	0.047
U4	0.056
W4	0.068
A5	0.1

Example:

Letter /Number	Value
A0	1PF
A1	10PF

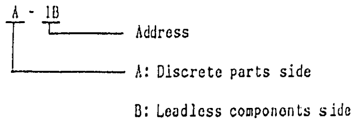
5. Leadless Jumper

The leadless jumper is indicated as shown below.



6. How to Read the Address of Leadless Components.

Address of leadless components



INTERNAL WIRING DIAGRAM

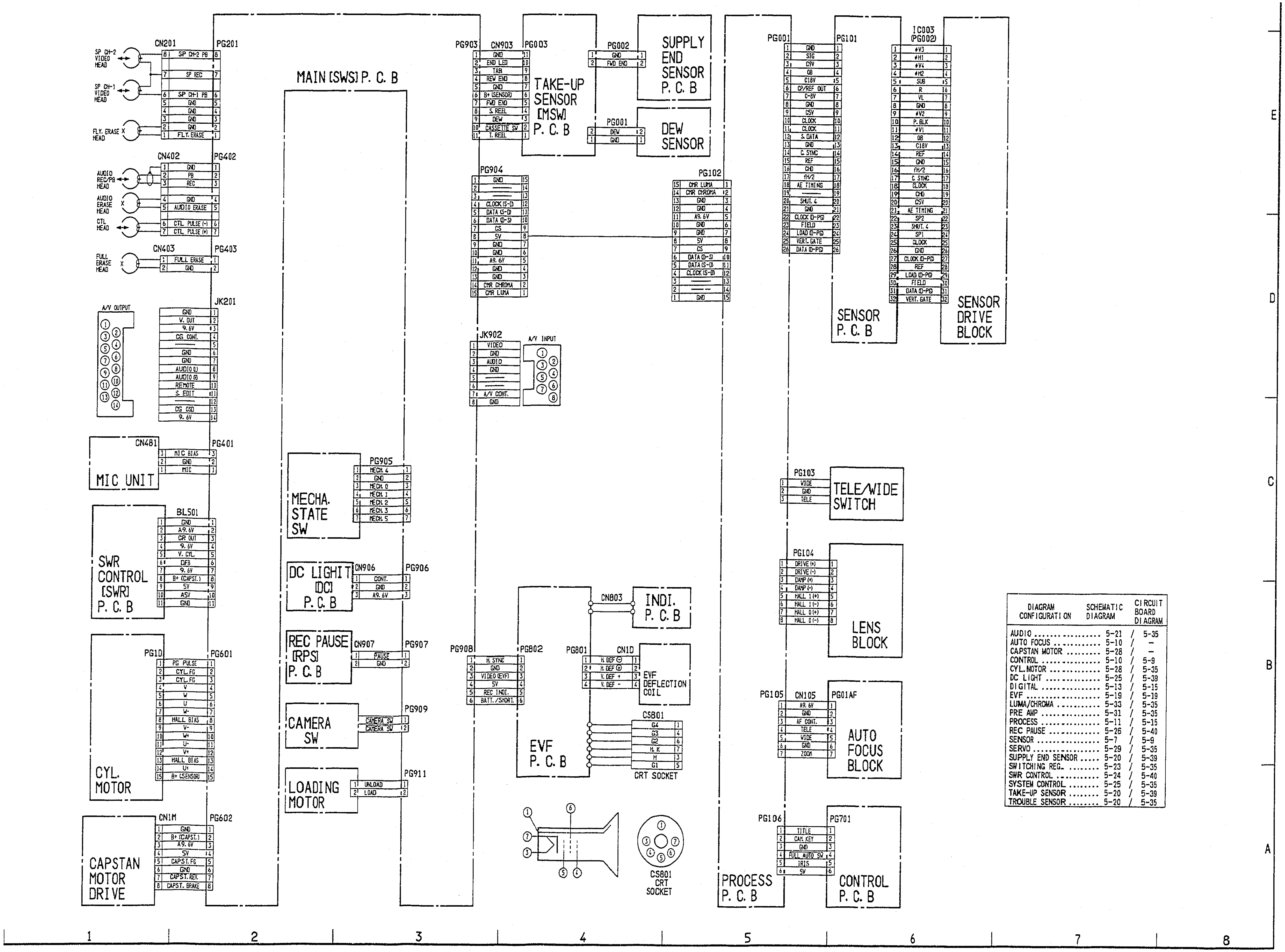
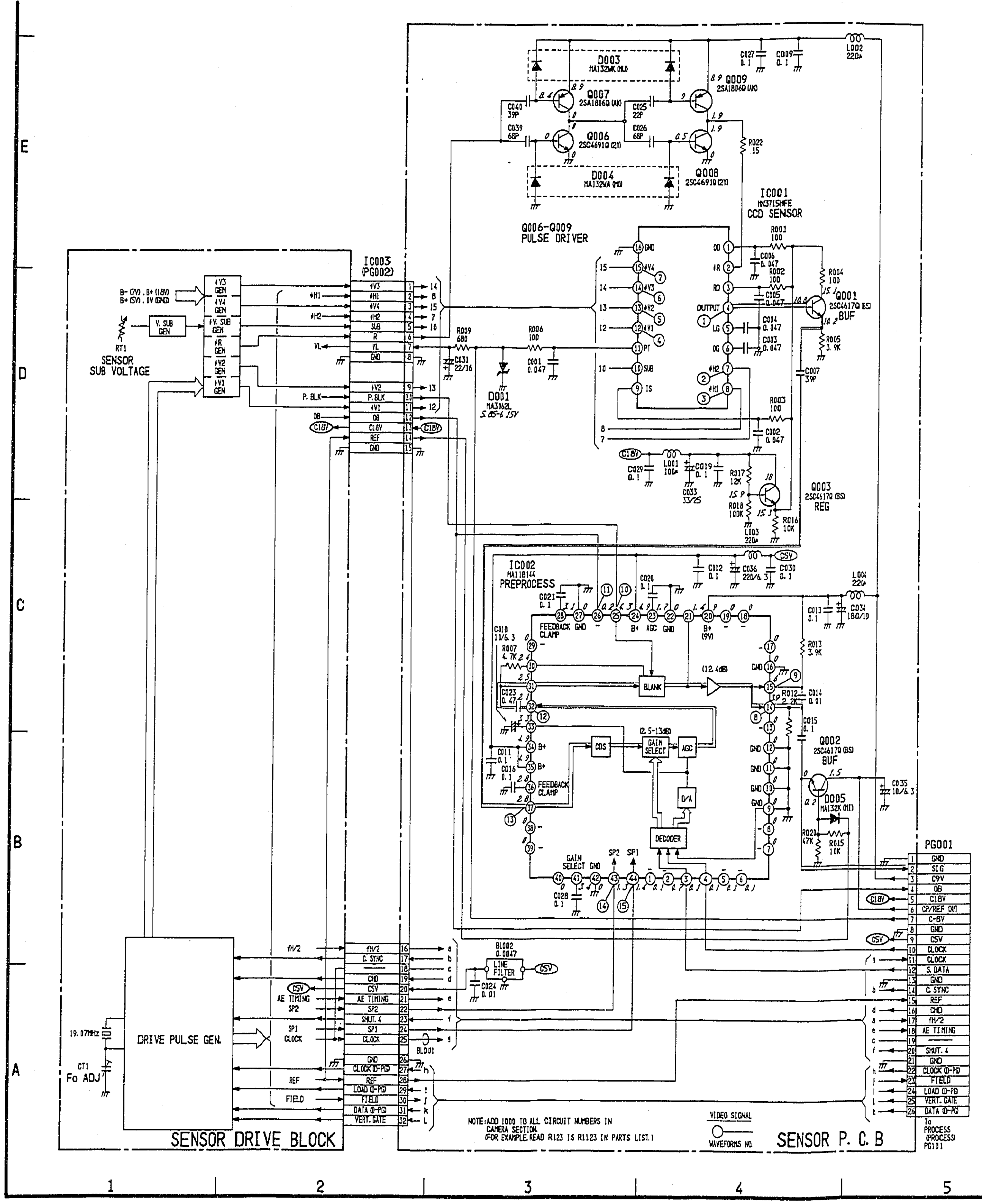

SP CH-2 VIDEO HEAD
SP CH-1 VIDEO HEAD
FLY. ERASE HEAD
CN201
PG201
8 SP CH-2 PB
7 SP REC
6 SP CH-1 PB
5 GND
4 GND
3 GND
2 GND
1 FLY. ERASE
AUDIO REC/PB HEAD
AUDIO ERASE HEAD
CTL HEAD
CN402
PG402
1 GND
2 PB
3 REC
4 GND
5 AUDIO ERASE
6 CTL PULSE (-)
7 CTL PULSE (+)
FULL ERASE HEAD
CN403
PG403
1 FULL ERASE
2 GND
A/V OUTPUT
JK201
1 GND
2 V. OUT
3 9.6V
4 CG CONT.
6 GND
7 GND
8 AUDIO (L)
9 AUDIO (R)
10 REMOTE
11 S. EDIT
13 CG OSD
14 9.6V
MIC UNIT
CN481
PG401
3 MIC BIAS
2 GND
1 MIC
SWR CONTROL [SWR] P. C. B
BL501
1 GND
2 A9.6V
3 CR OUT
4 9.6V
5 V. CYL.
6 DFB
7 9.6V
8 B+ (CAPST.)
9 5V
10 A5V
11 GND
CYL. MOTOR
PG1D
PG601
1 PG PULSE
2 CYL. FG
3 CYL. FG
4 V
5 W
6 U
7 W-
8 HALL BIAS
9 V-
10 W+
11 U-
12 V+
13 HALL BIAS
14 U+
15 B+ (SENSOR)
CAPSTAN MOTOR DRIVE
CN1M
PG602
1 GND
2 B+ (CAPST.)
3 A9.6V
4 5V
5 CAPST. FG
6 GND
7 CAPST. REV.
8 CAPST. BRAKE
MAIN [SWS] P. C. B
MECHA. STATE SW
PG905
1 MECH. 4
2 GND
3 MECH. 0
4 MECH. 1
5 MECH. 2
6 MECH. 3
7 MECH. 5
DC LIGHT [DC] P. C. B
CN906
PG906
1 CONT.
2 GND
3 A9.6V
REC PAUSE [RPS] P. C. B
CN907
PG907
1 PAUSE
2 GND
CAMERA SW
PG909
1 CAMERA SW
2 CAMERA SW
LOADING MOTOR
PG911
1 UNLOAD
2 LOAD
PG903
CN903
PG003
1 GND
2 END LED
3 TAB
4 REW END
5 GND
6 B+ (SENSOR)
7 FWD END
8 S. REEL
9 DEW
10 CASSETTE SW
11 T. REEL
TAKE-UP SENSOR [MSW] P. C. B
PG002
1 GND
2 FWD END
SUPPLY END SENSOR P. C. B
PG001
2 DEW
1 GND
DEW SENSOR
PG904
1 GND
4 CLOCK (S-D)
5 DATA (S-D)
6 DATA (D-S)
7 CS
8 5V
9 GND
10 GND
11 A9.6V
12 GND
13 GND
14 CMR CHROMA
15 CMR LUMA
PG102
15 CMR LUMA
14 CMR CHROMA
13 GND
12 GND
11 A9.6V
10 GND
9 GND
8 5V
7 CS
6 DATA (D-S)
5 DATA (S-D)
4 CLOCK (S-D)
1 GND
JK902
A/V INPUT
1 VIDEO
2 GND
3 AUDIO
4 GND
7 A/V CONT.
8 GND
PG908
PG802
1 H. SYNC
2 GND
3 VIDEO (EVF)
4 5V
5 REC INDI.
6 BATT./SHORT.
EVF P. C. B
CN803
INDI. P. C. B
PG801
CN1D
1 H. DEF ⊖
2 H. DEF ⊕
3 V. DEF +
4 V. DEF -
EVF DEFLECTION COIL
CS801
G4 1
G3 4
G2 6
H. K 7
H 3
G1 5
CRT SOCKET
①
⑥
⑦
③
⑤
④
CS801 CRT SOCKET
PG001
PG101
1 GND
2 SIG
3 C9V
4 OB
5 C18V
6 CP/REF OUT
7 C-8V
8 GND
9 C5V
10 CLOCK
11 CLOCK
12 S. DATA
13 GND
14 C. SYNC
15 REF
16 CHD
17 fH/2
18 AE TIMING
20 SHUT. 4
21 GND
22 CLOCK (D-PG)
23 FIELD
24 LOAD (D-PG)
25 VERT. GATE
26 DATA (D-PG)
SENSOR P. C. B
IC003 (PG002)
1 φV3
2 φH1
3 φV4
4 φH2
5 SUB
6 R
7 VL
8 GND
9 φV2
10 P. BLK
11 φV1
12 OB
13 C18V
14 REF
15 GND
16 fH/2
17 C. SYNC
18 CLOCK
19 CHD
20 C5V
21 AE TIMING
22 SP2
23 SHUT. 4
24 SP1
25 CLOCK
26 GND
27 CLOCK (D-PG)
28 REF
29 LOAD (D-PG)
30 FIELD
31 DATA (D-PG)
32 VERT. GATE
SENSOR DRIVE BLOCK
PG103
1 WIDE
2 GND
3 TELE
TELE/WIDE SWITCH
PG104
1 DRIVE (+)
2 DRIVE (-)
3 DAMP (+)
4 DAMP (-)
5 HALL 1 (+)
6 HALL 1 (-)
7 HALL 0 (+)
8 HALL 0 (-)
LENS BLOCK
PG105
CN105
PG01AF
1 A9.6V
2 GND
3 AF CONT.
4 TELE
5 WIDE
6 GND
7 ZOOM
AUTO FOCUS BLOCK
PG106
PG701
1 TITLE
2 CAM. KEY
3 GND
4 FULL AUTO SW
5 IRIS
6 5V
PROCESS P. C. B
CONTROL P. C. B
E
D
C
B
A
1
2
3
4
5
6
7
8

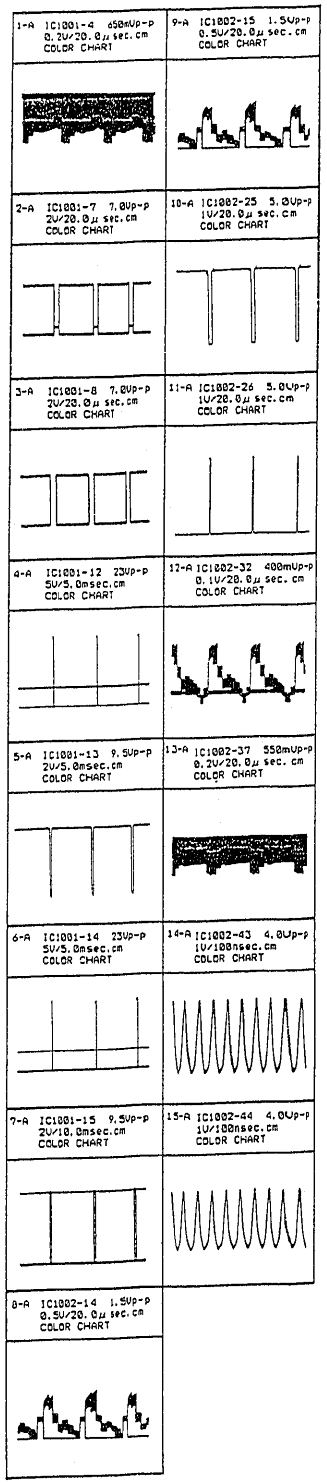
DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM		CIRCUIT BOARD DIAGRAM
AUDIO	5-21	/	5-35
AUTO FOCUS	5-10	/	–
CAPSTAN MOTOR	5-28	/	–
CONTROL	5-10	/	5-9
CYL.MOTOR	5-28	/	5-35
DC LIGHT	5-25	/	5-39
DIGITAL	5-13	/	5-15
EVF	5-19	/	5-19
LUMA/CHROMA	5-33	/	5-35
PRE AMP	5-31	/	5-35
PROCESS	5-11	/	5-15
REC PAUSE	5-26	/	5-40
SENSOR	5-7	/	5-9
SERVO	5-29	/	5-35
SUPPLY END SENSOR	5-20	/	5-39
SWITCHING REG.	5-23	/	5-35
SWR CONTROL	5-24	/	5-40
SYSTEM CONTROL	5-25	/	5-35
TAKE-UP SENSOR	5-20	/	5-39
TROUBLE SENSOR	5-20	/	5-35

SENSOR SCHEMATIC DIAGRAM

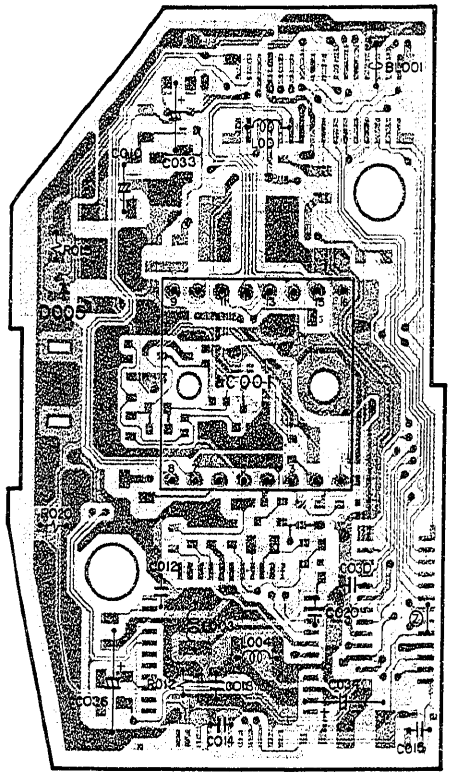

E
D
C
B
A
1
2
3
4
5
D003
MA132WK (ML)
Q007
2SA1806Q (W)
Q009
2SA1806Q (W)
C040
39P
C039
68P
C025
22P
C026
68P
Q006
2SC4691Q (2Y)
Q008
2SC4691Q (2Y)
D004
MA132WA (MK)
R022
15
C027
0.1
C009
0.1
L002
220µ
Q006-Q009
PULSE DRIVER
IC001
MN3715HFE
CCD SENSOR
R001
100
R002
100
R003
100
R004
100
C006
0.047
C005
0.047
C004
0.047
C003
0.047
C002
0.047
C007
39P
Q001
2SC4617Q (BS)
BUF
R005
3.9K
OUTPUT
IC003
(PG002)
B- (7V) . B+ (18V)
B+ (5V) . 0V (GND)
V. SUB
GEN
ϕV3 GEN
ϕV4 GEN
ϕV. SUB GEN
ϕR GEN
ϕV2 GEN
ϕV1 GEN
RT1
SENSOR
SUB VOLTAGE
ϕV3
ϕH1
ϕV4
ϕH2
SUB
R
VL
GND
ϕV2
P. BLK
ϕV1
OB
C18V
REF
GND
R009
680
C031
22/16
R006
100
D001
MA3062L
C001
0.047
C029
0.1
L001
100µ
C019
0.1
C033
33/25
R017
12K
R018
100K
L003
220µ
Q003
2SC4617Q (BS)
REG
R016
10K
IC002
HA11B144
PREPROCESS
C021
0.1
C020
0.1
C012
0.1
C036
220/6.3
C030
0.1
L004
220µ
C013
0.1
C034
180/10
C010
10/6.3
R007
4.7K
C023
0.47
C011
0.1
C016
0.1
FEEDBACK
CLAMP
GND
B+
AGC
B+
(9V)
(12.4dB)
BLANK
(2.5-13dB)
CDS
GAIN
SELECT
AGC
D/A
DECODER
GAIN
SELECT
SP2
SP1
C028
0.1
R013
3.9K
R012
2.2K
C014
0.01
C015
0.1
Q002
2SC4617Q (BS)
BUF
D005
MA132K (MI)
R020
47K
R015
10K
C035
10/6.3
PG001
GND
SIG
C9V
OB
C18V
CP/REF OUT
C-8V
GND
C5V
CLOCK
CLOCK
S. DATA
GND
C. SYNC
REF
CHD
fH/2
AE TIMING
SHUT. 4
GND
CLOCK (D-PG)
FIELD
LOAD (D-PG)
VERT. GATE
DATA (D-PG)
To
PROCESS
(PROCESS)
PG101
19.07MHz
CT1
Fo ADJ
DRIVE PULSE GEN.
fH/2
C. SYNC
CHD
C5V
AE TIMING
SP2
SHUT. 4
SP1
CLOCK
GND
CLOCK (D-PG)
REF
LOAD (D-PG)
FIELD
DATA (D-PG)
VERT. GATE
BL002
0.0047
LINE
FILTER
C024
0.01
BL001
SENSOR DRIVE BLOCK
VIDEO SIGNAL
WAVEFORMS NO.
SENSOR P. C. B

NOTE: ADD 1000 TO ALL CIRCUIT NUMBERS IN CAMERA SECTION.
(FOR EXAMPLE, READ R123 IS R1123 IN PARTS LIST.)

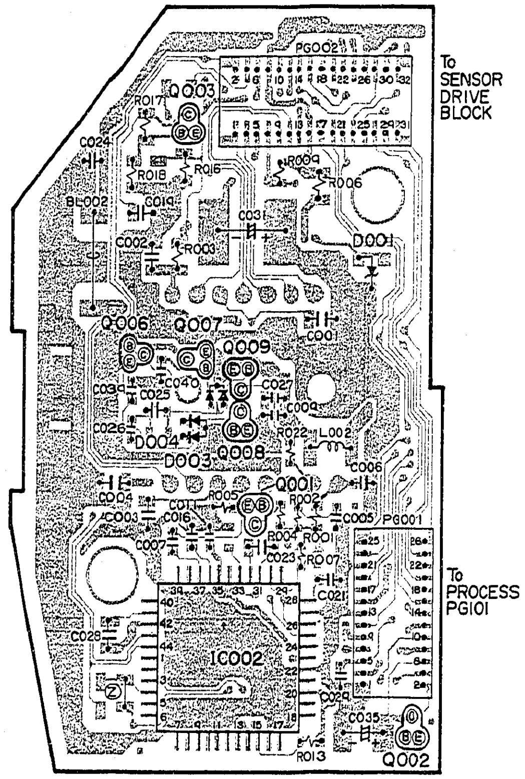
SENSOR WAVEFORMS



SENSOR CIRCUIT BOARD DIAGRAM


BL001
C019
C033
R020
D005
IC001
C036
C014
C015
C016
C012
L004
C020

SENSOR P.C.B
(COMPONENT SIDE)

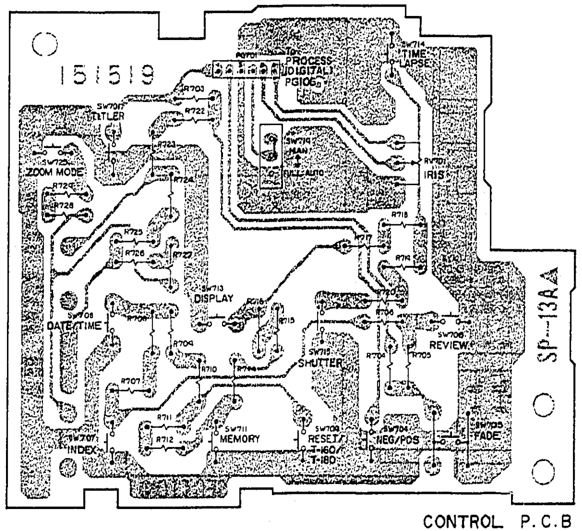

To SENSOR DRIVE BLOCK
PG002
Q003
R017
C024
R018
R016
C019
R009
R006
BL002
C031
C002
R003
D001
Q006
Q007
C001
Q009
C025
C040
C027
C009
C026
D004
R022
L002
D003
Q008
C004
R005
Q001
R002
C003
C011
C016
C005
PG001
C007
R004
R001
C023
R007
To PROCESS PG101
C028
C021
IC002
C029
C035
R013
Q002

SENSOR P.C.B
(SOLDER SIDE)

※ NOTE : MARK "Ⓩ" IS LEADLESS(CHIP)JUMPER.
: ADD 1000 TO ALL CIRCUIT NUMBERS
IN CAMERA SECTION.
(FOR EXAMPLE, READ R123 IS R1123 IN
PARTS LIST.)

※ NOTE : MARK "Ⓩ" IS LEADLESS(CHIP)JUMPER.
: ADD 1000 TO ALL CIRCUIT NUMBERS
IN CAMERA SECTION.
(FOR EXAMPLE, READ R123 IS R1123 IN
PARTS LIST.)

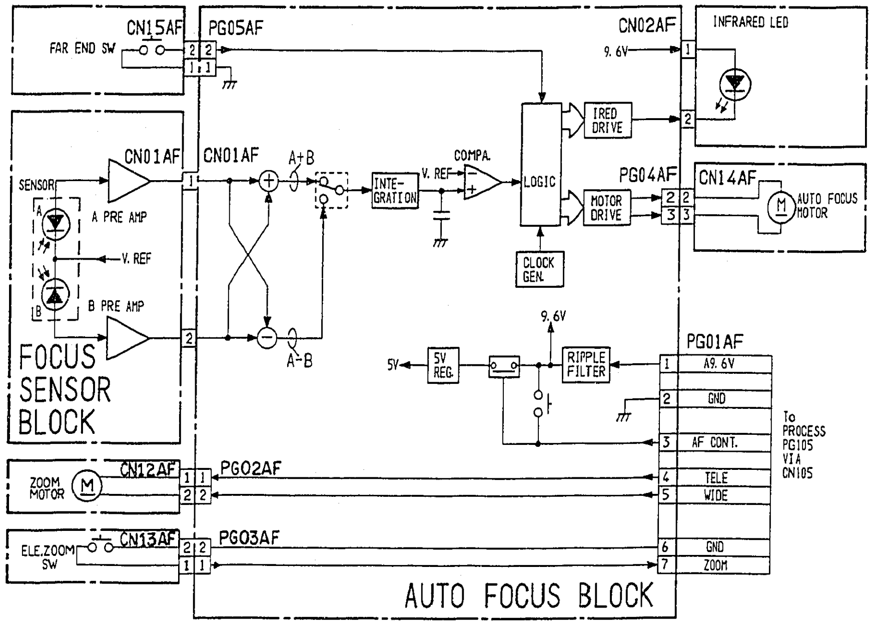
CONTROL CIRCUIT BOARD DIAGRAM


151519
TO PROCESS (DIGITAL) PG106
SW714 TIME LAPSE
SW701 TITLER
R703
R722
R723
R724
SW725 ZOOM MODE
SW719 MAN FULL AUTO
RV701 IRIS
R728
R726
R718
R716
SW713 DISPLAY
SW708 DATE/TIME
SW715 SHUTTER
SW706 REVIEW
R704
R705
R707
R710
SW711 MEMORY
SW707 INDEX
SW709 RESET/T-160/T-180
SW704 NEG/POS
SW705 FADE
SP-13AA

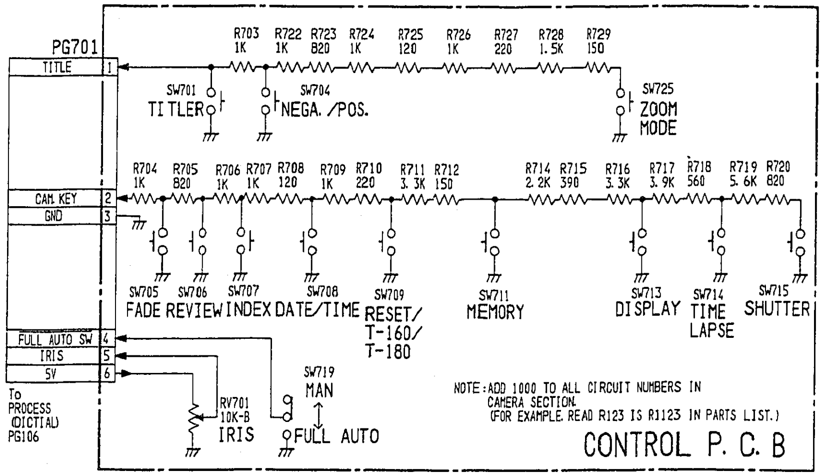
CONTROL P.C.B

DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM		CIRCUIT BOARD DIAGRAM
AUDIO	5-21	/	5-35
AUTO FOCUS	5-10	/	–
CAPSTAN MOTOR	5-28	/	–
CONTROL	5-10	/	5-9
CYL. MOTOR	5-28	/	5-35
DC LIGHT	5-25	/	5-39
DIGITAL	5-13	/	5-15
EVF	5-19	/	5-19
LUMA/CHROMA	5-33	/	5-35
PRE AMP	5-31	/	5-35
PROCESS	5-11	/	5-15
REC PAUSE	5-26	/	5-40
SENSOR	5-7	/	5-9
SERVO	5-29	/	5-35
SUPPLY END SENSOR	5-20	/	5-39
SWITCHING REG.	5-23	/	5-35
SWR CONTROL	5-24	/	5-40
SYSTEM CONTROL	5-25	/	5-35
TAKE-UP SENSOR	5-20	/	5-39
TROUBLE SENSOR	5-20	/	5-35

AUTO FOCUS BLOCK DIAGRAM

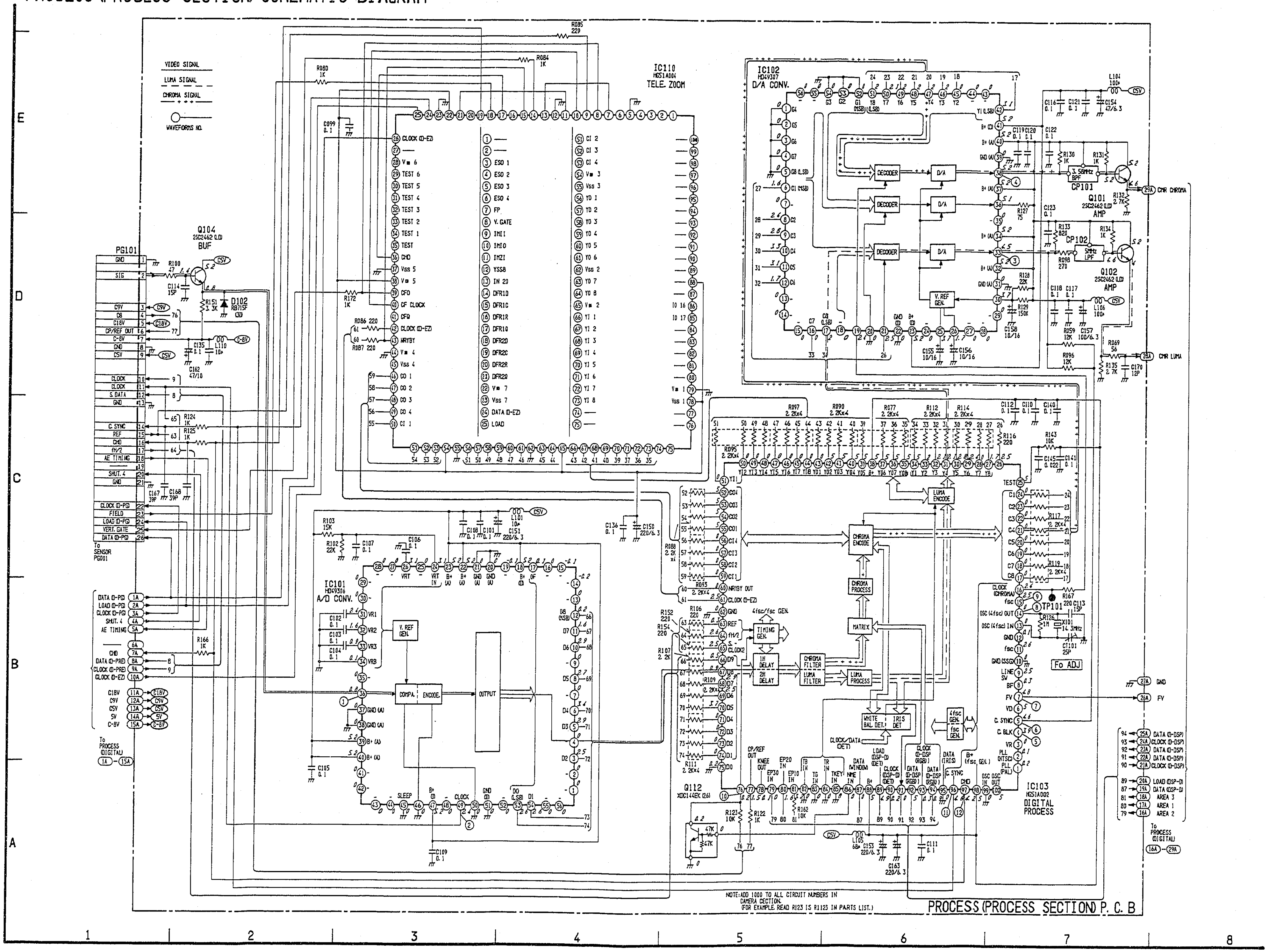

CN15AF
FAR END SW
PG05AF
CN02AF
9.6V
INFRARED LED
IRED DRIVE
CN01AF
CN01AF
A+B
COMPA.
V. REF
INTE-GRATION
LOGIC
PG04AF
CN14AF
MOTOR DRIVE
AUTO FOCUS MOTOR
SENSOR
A PRE AMP
V. REF
B PRE AMP
A-B
CLOCK GEN.
9.6V
FOCUS SENSOR BLOCK
5V
5V REG.
RIPPLE FILTER
PG01AF
A9.6V
GND
AF CONT.
TELE
WIDE
GND
ZOOM
To PROCESS PG105 VIA CN105
ZOOM MOTOR
CN12AF
PG02AF
ELE.ZOOM SW
CN13AF
PG03AF
AUTO FOCUS BLOCK

CONTROL SCHEMATIC DIAGRAM


PG701
TITLE
CAM KEY
GND
FULL AUTO SW
IRIS
5V
R703 1K
R722 1K
R723 820
R724 1K
R725 120
R726 1K
R727 220
R728 1.5K
R729 150
SW701 TITLER
SW704 NEGA./POS.
SW725 ZOOM MODE
R704 1K
R705 820
R706 1K
R707 1K
R708 120
R709 1K
R710 220
R711 3.3K
R712 150
R714 2.2K
R715 390
R716 3.3K
R717 3.9K
R718 560
R719 5.6K
R720 820
SW705 FADE
SW706 REVIEW
SW707 INDEX
SW708 DATE/TIME
SW709 RESET/T-160/T-180
SW711 MEMORY
SW713 DISPLAY
SW714 TIME LAPSE
SW715 SHUTTER
To PROCESS (DIGITAL) PG106
RV701 10K-B IRIS
SW719 MAN FULL AUTO
CONTROL P. C. B

NOTE: ADD 1000 TO ALL CIRCUIT NUMBERS IN CAMERA SECTION.
(FOR EXAMPLE, READ R123 IS R1123 IN PARTS LIST.)

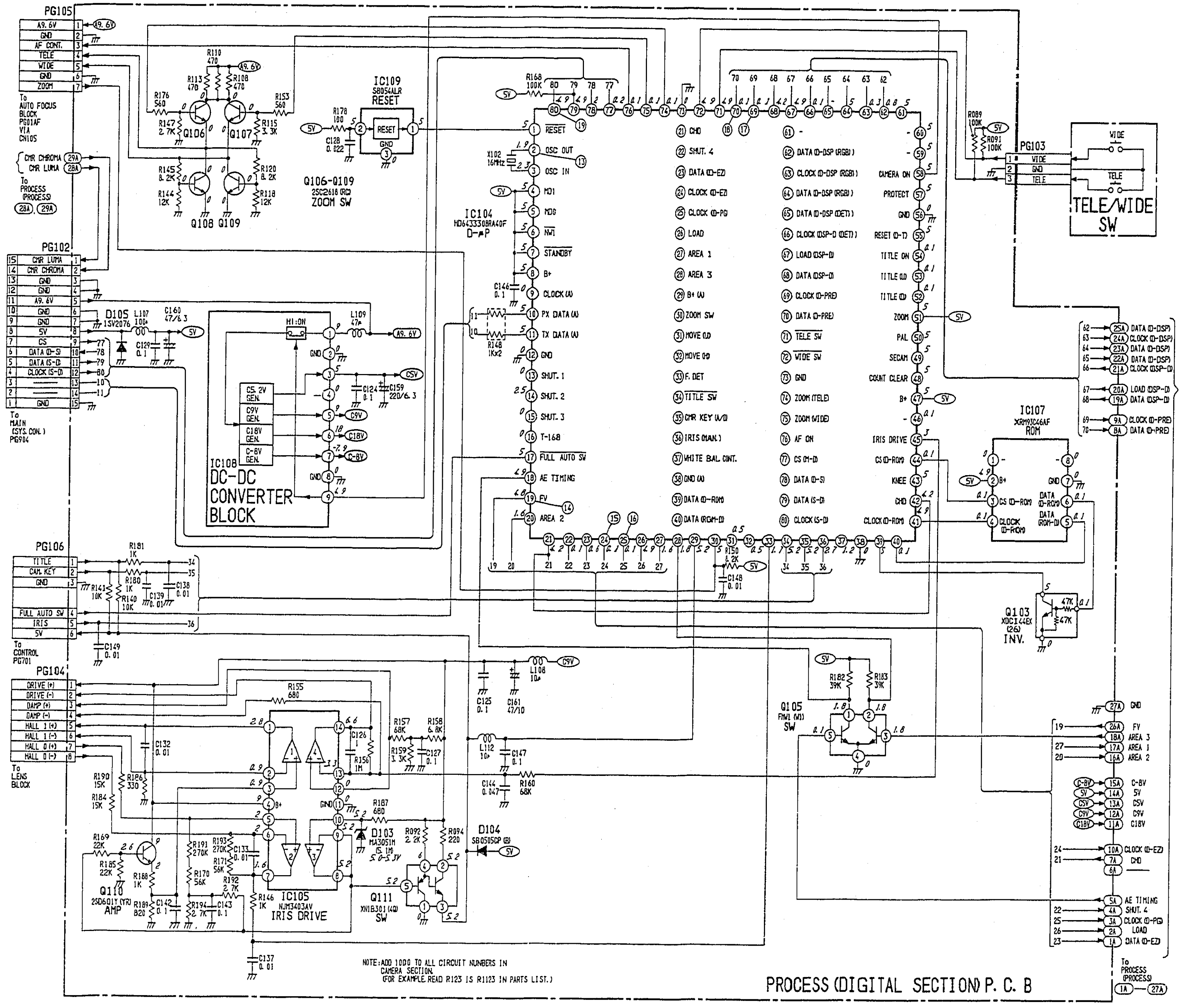
PROCESS (PROCESS SECTION) SCHEMATIC DIAGRAM


VIDEO SIGNAL
LUMA SIGNAL
CHROMA SIGNAL
WAVEFORMS NO.
IC110 MN51A004 TELE. ZOOM
IC102 MN49307 D/A CONV.
DECODER
D/A
V. REF GEN.
CP101 3.58MHz BPF
Q101 2SC2462 (LD) AMP
CP102 5MHz LPF
Q102 2SC2462 (LD) AMP
CMR CHROMA
CMR LUMA
PG101
Q104 2SC2462 (LD) BUF
D102 RB715F (30)
To SENSOR PG001
To PROCESS (DIGITAL) (1A)-(15A)
IC101 MN49306 A/D CONV.
V. REF GEN.
COMPA. ENCODE
OUTPUT
CHROMA ENCODE
CHROMA PROCESS
MATRIX
LUMA ENCODE
TIMING GEN.
1H DELAY
2H DELAY
CHROMA FILTER
LUMA FILTER
LUMA PROCESS
WHITE BAL DET.
IRIS DET
4fsc GEN.
fsc GEN.
4fsc/fsc GEN.
TP101
X101 14.3MHz
Fo ADJ
IC103 MN51A002 DIGITAL PROCESS
Q112 XDC144EK (26)
To PROCESS (DIGITAL) (16A)-(29A)
1
2
3
4
5
6
7
8
A
B
C
D
E

NOTE: ADD 1000 TO ALL CIRCUIT NUMBERS IN CAMERA CECTION.
(FOR EXAMPLE READ R123 IS R1123 IN PARTS LIST.)

PROCESS (PROCESS SECTION) P. C. B

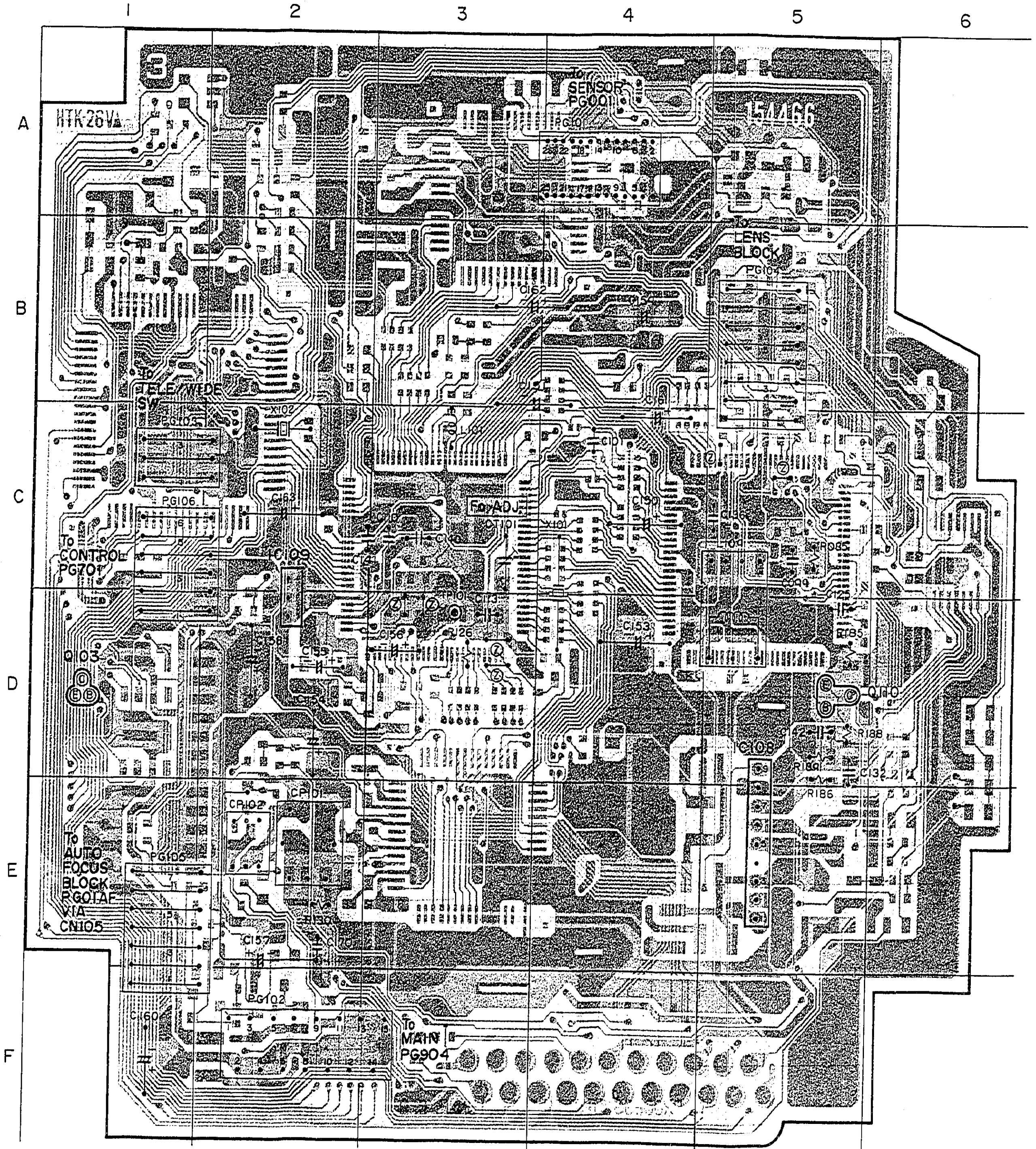
PROCESS (DIGITAL SECTION) SCHEMATIC DIAGRAM


PG105
A9.6V
GND
AF CONT.
TELE
WIDE
GND
ZOOM
To AUTO FOCUS BLOCK PG01AF VIA CN105
CMR CHROMA
CMR LUMA
To PROCESS (PROCESS) 28A 29A
PG102
To MAIN (SYS.CON.) PG904
D105 1SV207
IC109 S8054ALR RESET
Q106-Q109 2SC2618 (RC) ZOOM SW
IC104 HD6433308RA40F D-µP
IC108 DC-DC CONVERTER BLOCK
C5.2V GEN.
C9V GEN.
C18V GEN.
C-8V GEN.
PG103
TELE/WIDE SW
IC107 XRM93C46AF ROM
Q103 XDIC144EK (26) INV.
PG106
TITLE
CAM. KEY
GND
FULL AUTO SW
IRIS
5V
To CONTROL PG701
PG104
DRIVE (+)
DRIVE (-)
DAMP (+)
DAMP (-)
HALL 1 (+)
HALL 1 (-)
HALL 0 (+)
HALL 0 (-)
To LENS BLOCK
Q110 2SD601 (YR) AMP
IC105 NJM3403AV IRIS DRIVE
D103 MA3051M
Q111 XN1B301 (4G) SW
D104 SB0505CP
Q105 FMW1 (W1) SW
To PROCESS (PROCESS) 1A — 27A
PROCESS (DIGITAL SECTION) P.C.B
E
D
C
B
A
1
2
3
4
5
6
7
8

NOTE: ADD 1000 TO ALL CIRCUIT NUMBERS IN CAMERA SECTION.
(FOR EXAMPLE READ R123 IS R1123 IN PARTS LIST.)

DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM	CIRCUIT BOARD DIAGRAM
AUDIO	5-21	5-35
AUTO FOCUS	5-10	—
CAPSTAN MOTOR	5-28	—
CONTROL	5-10	5-9
CYL. MOTOR	5-28	5-35
DC LIGHT	5-25	5-39
DIGITAL	5-13	5-15
EVF	5-19	5-19
LUMA/CHROMA	5-33	5-35
PRE AMP	5-31	5-35
PROCESS	5-11	5-15
REC PAUSE	5-26	5-40
SENSOR	5-7	5-9
SERVO	5-29	5-35
SUPPLY END SENSOR	5-20	5-39
SWITCHING REG.	5-23	5-35
SWR CONTROL	5-24	5-40
SYSTEM CONTROL	5-25	5-35
TAKE-UP SENSOR	5-20	5-39
TROUBLE SENSOR	5-20	5-35

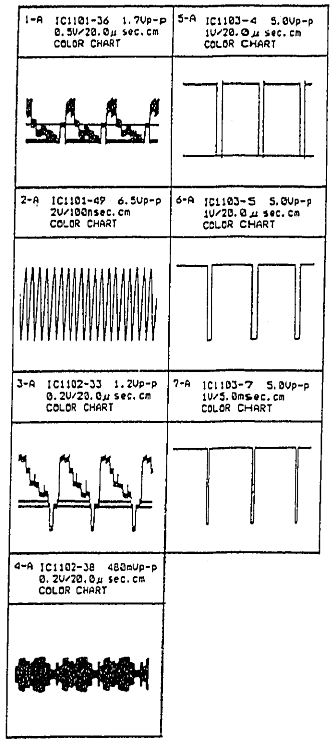
PROCESS CIRCUIT BOARD DIAGRAM (SIDE A)

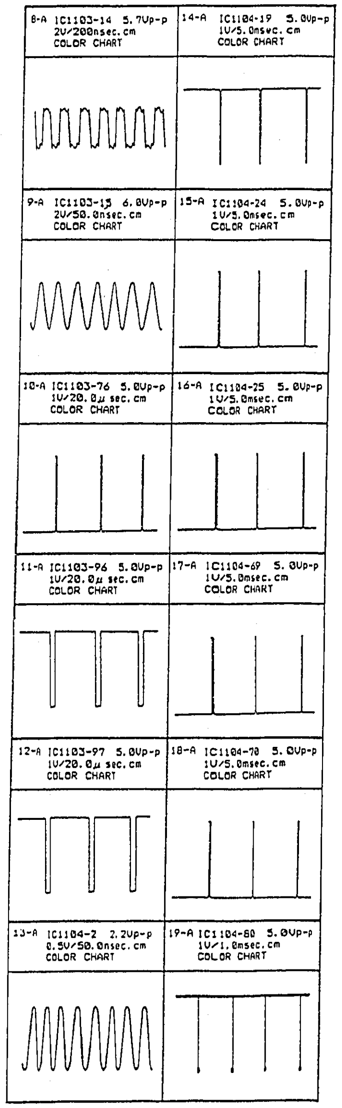

1
2
3
4
5
6
A
B
C
D
E
F
3
HTK-26VA
To SENSOR PG001
54466
To LENS BLOCK PG101
C162
TELE/WIDE SW
PG103
X102
L101
C110
PG106
To CONTROL PG701
C183
IC109
For ADJ.
IC101
IC150
Q109
R185
TP101
C173
C159
C156
L126
C153
C158
Q103
Q110
R188
IC108
R189
C132
R186
CP101
CR102
To AUTO FOCUS BLOCK PG01AF VIA CN105
PG105
C157
PG102
C160
To MAIN PG904

NOTE : MARK "Ⓩ" IS LEADLESS (CHIP) JUMPER.
: ADD 1000 TO ALL CIRCUIT NUMBERS IN CAMERA SECTION.
(FOR EXAMPLE, READ R123 IS R1123 IN PARTS LIST.)

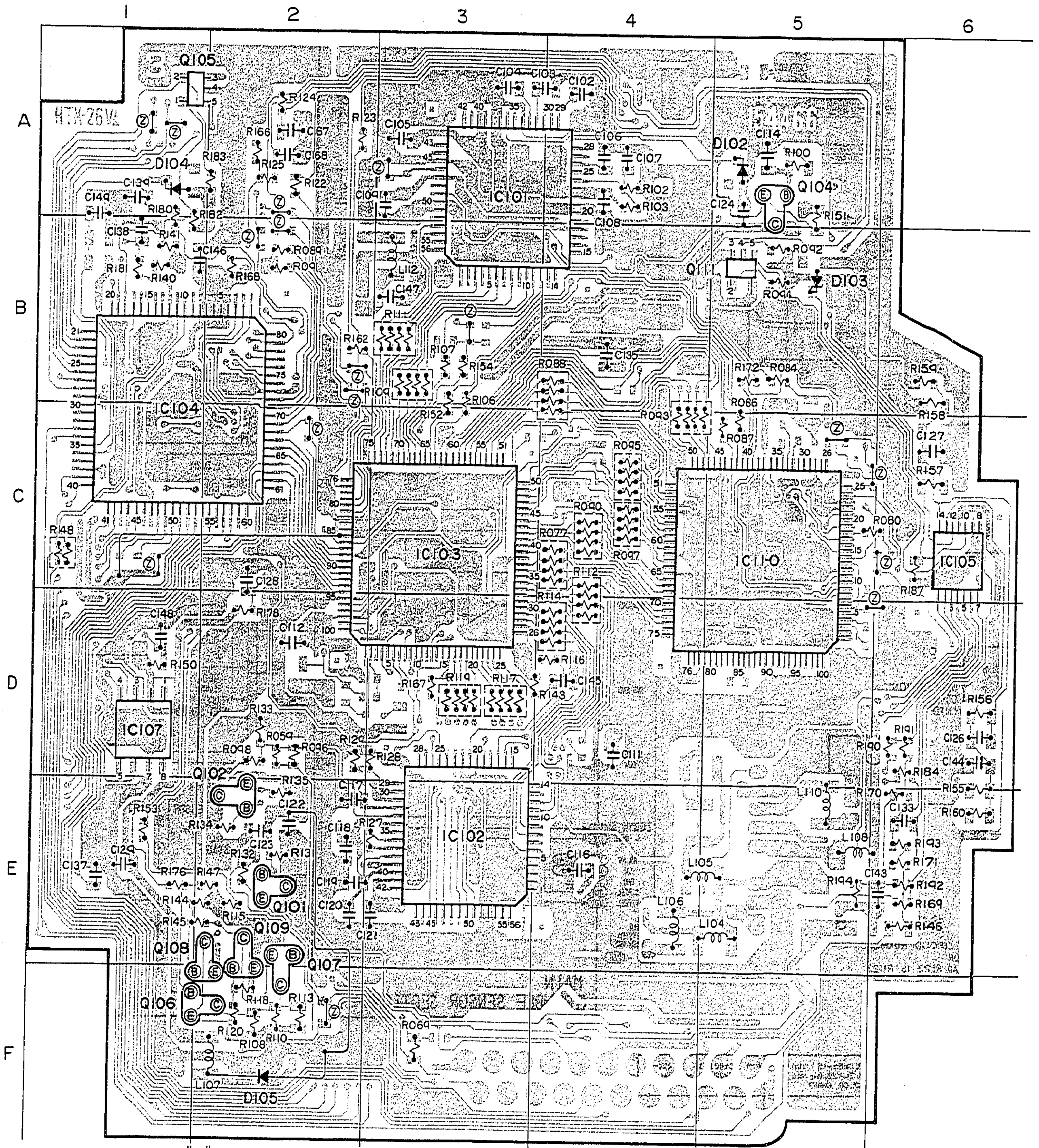
PROCESS P.C.B (SIDE A)

PROCESS WAVEFORMS





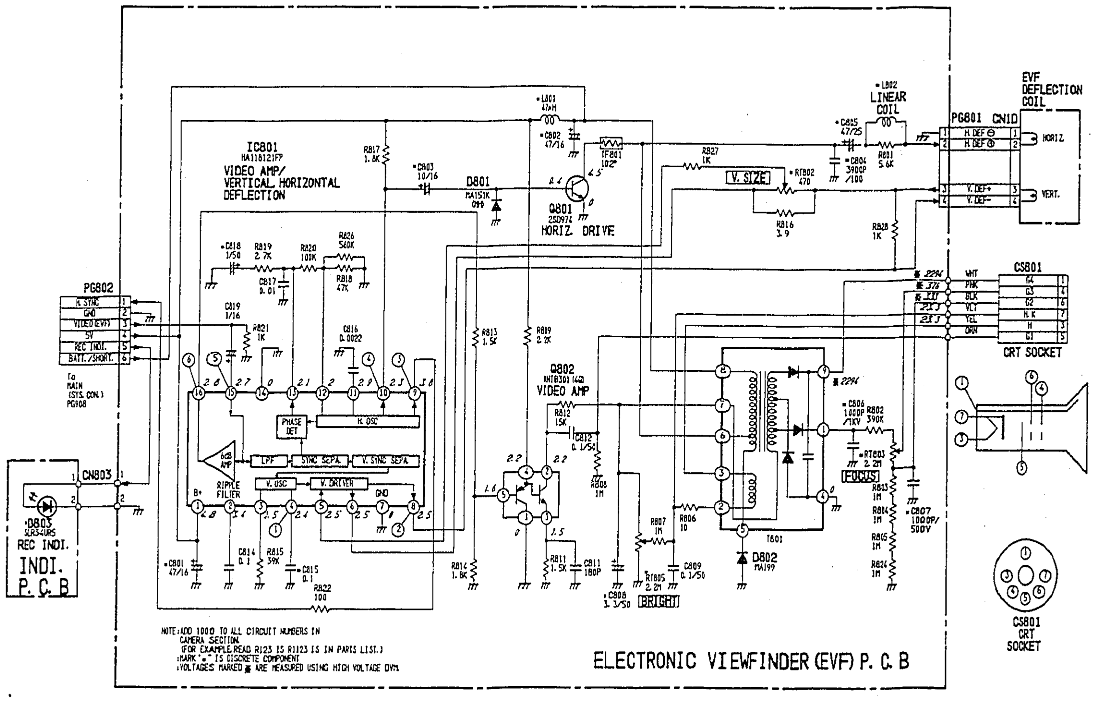
PROCESS CIRCUIT BOARD DIAGRAM (SIDE B)


1
2
3
4
5
6
A
B
C
D
E
F
HTN-26VL
Q105
R124
R166
C167
C168
R125
R122
R123
C105
C104
C103
C102
IC101
C106
C107
R102
R103
C108
D102
C114
R100
Q104
C124
R151
R092
Q111
R094
D103
D104
R183
C139
C140
R180
R182
C138
R141
C146
R089
R091
R181
R140
R168
C109
L112
C147
R111
R162
R107
R154
R109
R106
R152
R088
C135
R172
R084
R086
R093
R087
R159
R158
C127
R157
IC104
IC103
R095
R090
R077
R097
R112
R114
R116
IC110
R080
IC105
R187
R48
C128
R178
C148
C112
R150
R167
R119
R117
R143
C145
R156
IC107
R133
R098
R054
R096
R129
R126
Q102
R135
C122
C111
R190
R191
C126
C144
R184
R170
R155
R160
L110
C117
R127
C118
R153
R134
C123
R132
R131
IC102
C133
R193
L108
C116
C129
C137
R176
R147
C119
Q101
C120
L105
R194
C143
R171
R192
R169
R146
R144
R145
R115
Q109
C121
L106
L104
Q108
Q107
R118
R113
Q106
R120
R110
R108
R069
L107
D105

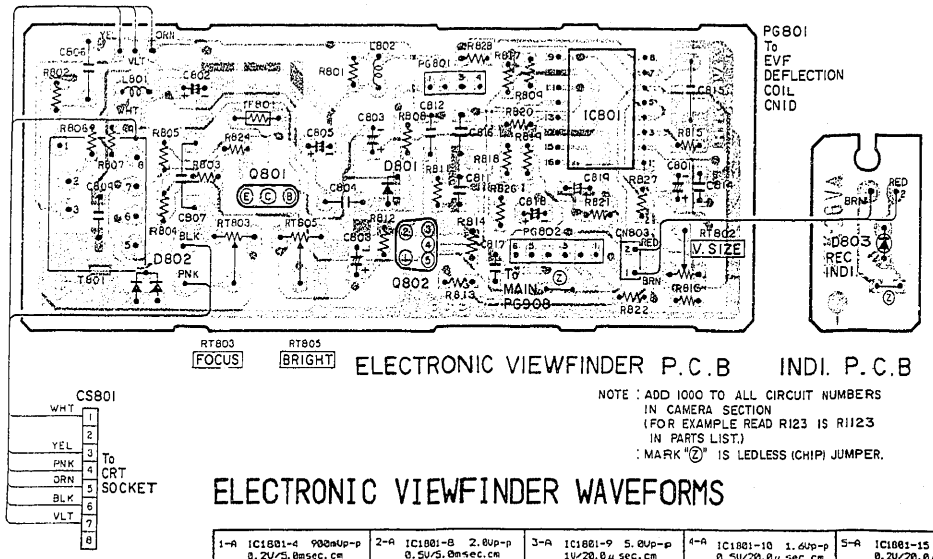
NOTE : MARK "Ⓩ" IS LEADLESS(CHIP) JUMPER.
: ADD 1000 TO ALL CIRCUIT NUMBERS IN CAMERA SECTION.
(FOR EXAMPLE, READ R123 IS R1123 IN PARTS LIST.)

PROCESS P.C.B (SIDE B)

ELECTRONIC VIEWFINDER (EVF) SCHEMATIC DIAGRAM


IC801
VIDEO AMP/
VERTICAL HORIZONTAL
DEFLECTION
Q801
HORIZ. DRIVE
Q802
VIDEO AMP
D801
D802
V. SIZE
FOCUS
BRIGHT
LINEAR COIL
EVF DEFLECTION COIL
PG801 CN1D
PG802
CN803
D803
REC INDI.
INDI. P.C.B
CS801
CRT SOCKET
ELECTRONIC VIEWFINDER (EVF) P.C.B

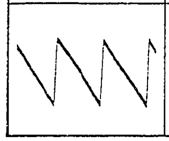
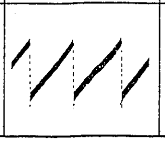
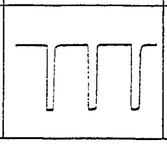
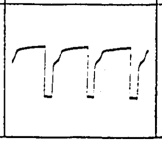
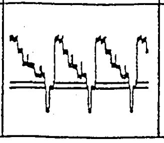
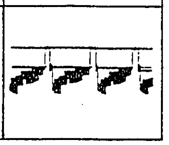
ELECTRONIC VIEWFINDER (EVF) CIRCUIT BOARD DIAGRAM


PG801
To
EVF
DEFLECTION
COIL
CN1D
Q801
Q802
D801
D802
D803
REC
INDI
V. SIZE
To
MAIN
PG908
RT803
FOCUS
RT805
BRIGHT
CS801
WHT
YEL
PNK
ORN
BLK
VLT
To
CRT
SOCKET

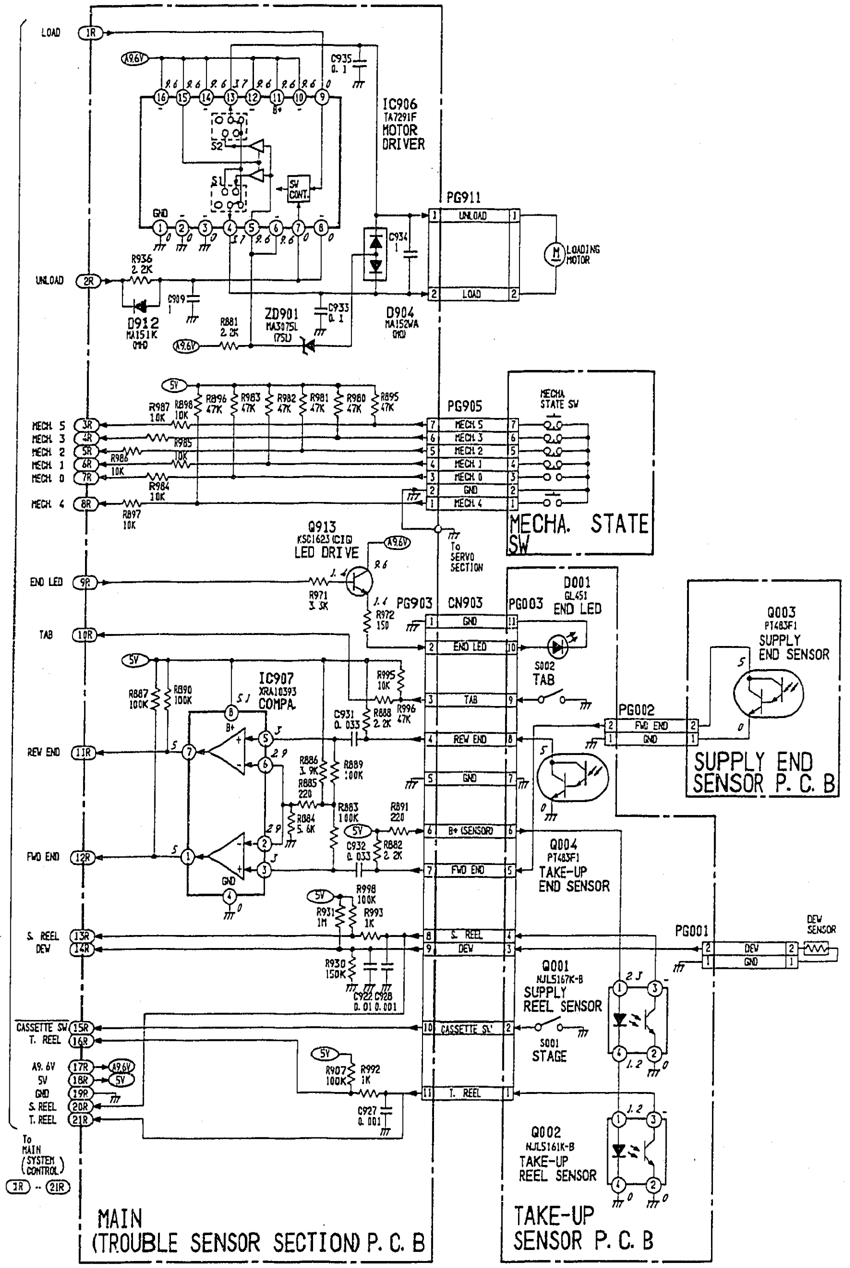
ELECTRONIC VIEWFINDER P.C.B INDI. P.C.B

NOTE : ADD 1000 TO ALL CIRCUIT NUMBERS
IN CAMERA SECTION
(FOR EXAMPLE READ R123 IS R1123
IN PARTS LIST.)
: MARK "Ⓩ" IS LEDLESS (CHIP) JUMPER.

ELECTRONIC VIEWFINDER WAVEFORMS

1-A IC1801-4 900mVp-p 0.2V/5.0msec.cm COLOR CHART	2-A IC1801-8 2.0Vp-p 0.5V/5.0msec.cm COLOR CHART	3-A IC1801-9 5.0Vp-p 1V/20.0μ sec.cm COLOR CHART	4-A IC1801-10 1.6Vp-p 0.5V/20.0μ sec.cm COLOR CHART	5-A IC1801-15 1Vp-p 0.2V/20.0μ sec.cm COLOR CHART	6-A IC1801-16 3.0Vp-p 1V/20.0μ sec.cm COLOR CHART
					

MAIN (TROUBLE SENSOR SECTION) SCHEMATIC DIAGRAM


IC906
TA7291F
MOTOR
DRIVER
PG911
LOADING MOTOR
D912
ZD901
D904
PG905
MECHA. STATE SW
MECHA. STATE SW
Q913
LED DRIVE
PG903
CN903
PG003
D001
END LED
Q003
SUPPLY END SENSOR
S002
TAB
PG002
SUPPLY END SENSOR P.C.B
IC907
XRA10393
COMPA.
Q004
TAKE-UP END SENSOR
PG001
DEW SENSOR
Q001
SUPPLY REEL SENSOR
S001
STAGE
Q002
TAKE-UP REEL SENSOR
TAKE-UP SENSOR P.C.B
To MAIN (SYSTEM CONTROL) 2R - 21R
MAIN (TROUBLE SENSOR SECTION) P.C.B

MAIN (AUDIO SECTION) SCHEMATIC DIAGRAM

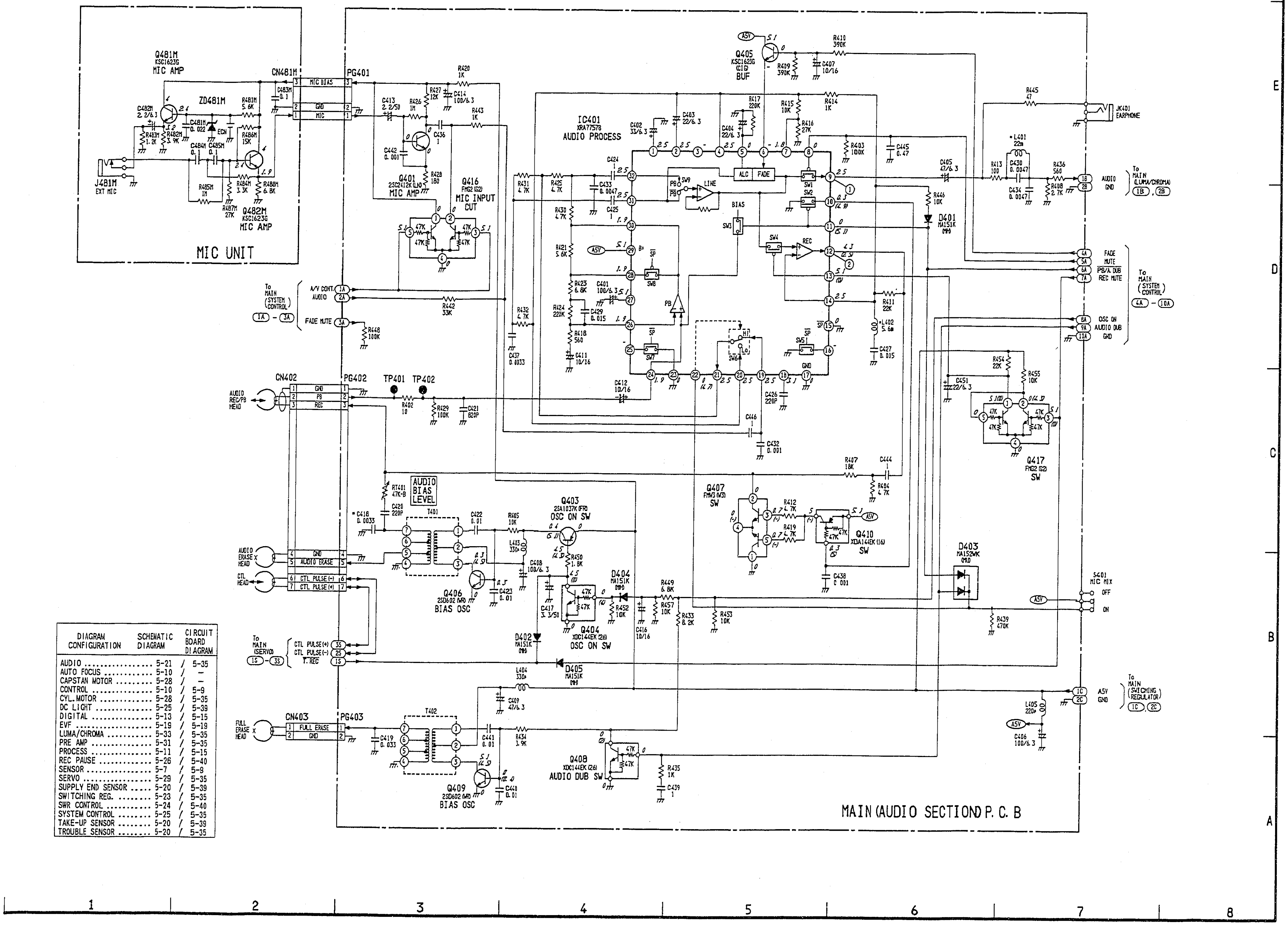
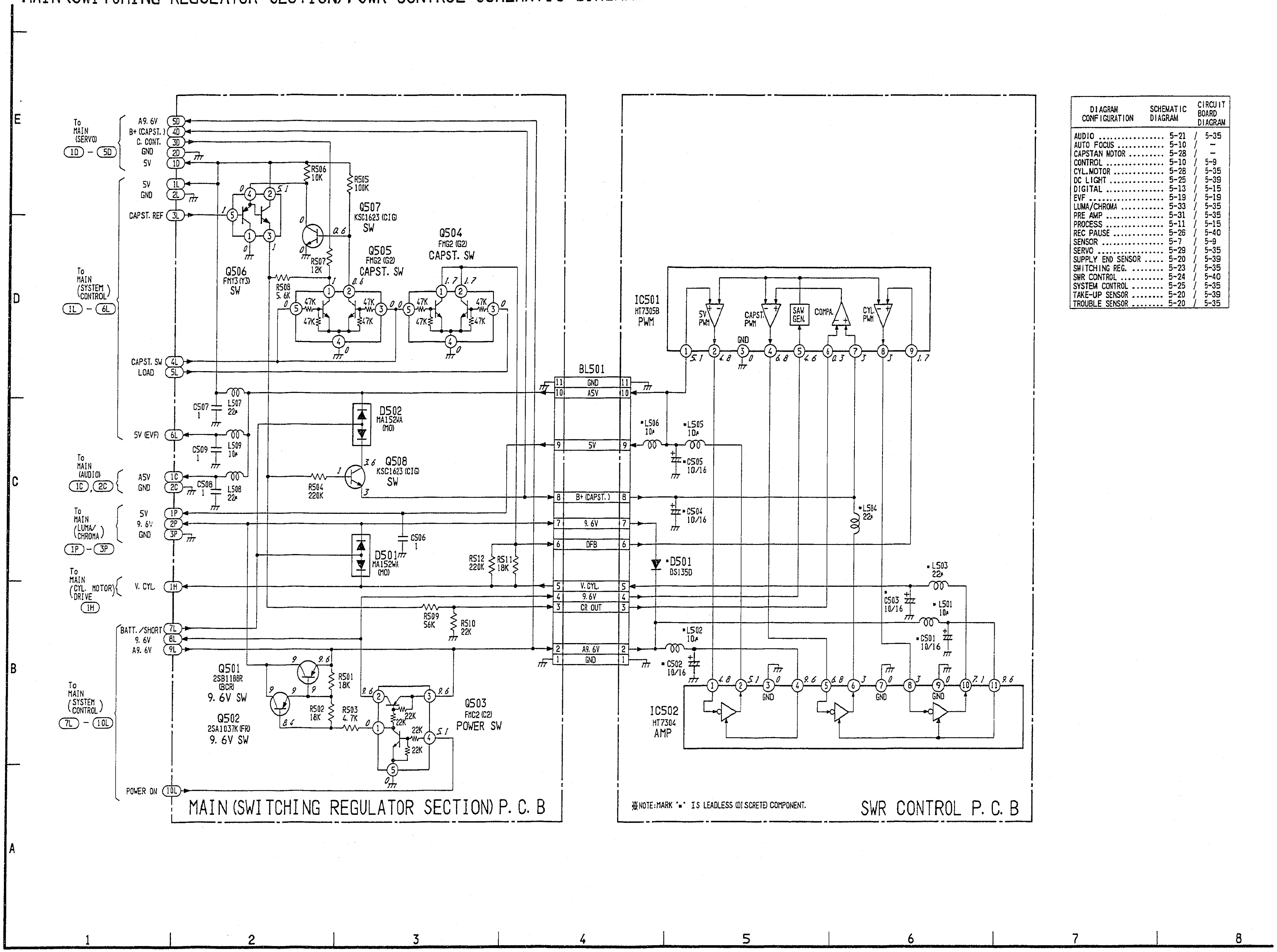

MIC UNIT
Q481M KSC1623G MIC AMP
Q482M KSC1623G MIC AMP
ZD481M
J481M EXT MIC
CN481M
PG401
MIC BIAS
GND
MIC
Q401 2SC2412K (LQ) MIC AMP
Q416 FMG2 (G2) MIC INPUT CUT
IC401 XRA7757B AUDIO PROCESS
Q405 KSC1623G (C1G) BUF
ALC
FADE
LINE
BIAS
REC
PB
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
HI
Lo
D401 MA151K
JK401 EARPHONE
To MAIN (LUMA/CHROMA) 1B, 2B
AUDIO
GND
FADE
MUTE
PB/A.DUB
REC MUTE
To MAIN (SYSTEM CONTROL) 4A - 10A
OSC ON
AUDIO DUB
To MAIN (SYSTEM CONTROL) 1A - 3A
A/V CONT.
FADE MUTE
CN402
PG402
TP401
TP402
AUDIO REC/PB HEAD
AUDIO BIAS LEVEL
RT401 47K-B
T401
Q403 2SA1037K (FR) OSC ON SW
Q404 XDC144EK (26) OSC ON SW
Q406 2SD602 (WR) BIAS OSC
Q407 FMW3 (W3) SW
Q410 XDA144EK (16) SW
Q417 FMG2 (G2) SW
D402 MA151K
D403 MA152WK
D404 MA151K
D405 MA151K
AUDIO ERASE HEAD
CTL HEAD
AUDIO ERASE
CTL PULSE (-)
CTL PULSE (+)
To MAIN (SERVO) 1S - 3S
T. REC
S401 MIC MIX
OFF
ON
To MAIN (SWITCHING REGULATOR) 1C, 2C
A5V
CN403
PG403
FULL ERASE HEAD
FULL ERASE
T402
Q408 XDC144EK (26) AUDIO DUB SW
Q409 2SD602 (WR) BIAS OSC
MAIN (AUDIO SECTION) P. C. B
1
2
3
4
5
6
7
8
A
B
C
D
E

DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM	CIRCUIT BOARD DIAGRAM
AUDIO	5-21 /	5-35
AUTO FOCUS	5-10 /	–
CAPSTAN MOTOR	5-28 /	–
CONTROL	5-10 /	5-9
CYL. MOTOR	5-28 /	5-35
DC LIGHT	5-25 /	5-39
DIGITAL	5-13 /	5-15
EVF	5-19 /	5-19
LUMA/CHROMA	5-33 /	5-35
PRE AMP	5-31 /	5-35
PROCESS	5-11 /	5-15
REC PAUSE	5-26 /	5-40
SENSOR	5-7 /	5-9
SERVO	5-29 /	5-35
SUPPLY END SENSOR	5-20 /	5-39
SWITCHING REG.	5-23 /	5-35
SWR CONTROL	5-24 /	5-40
SYSTEM CONTROL	5-25 /	5-35
TAKE-UP SENSOR	5-20 /	5-39
TROUBLE SENSOR	5-20 /	5-35

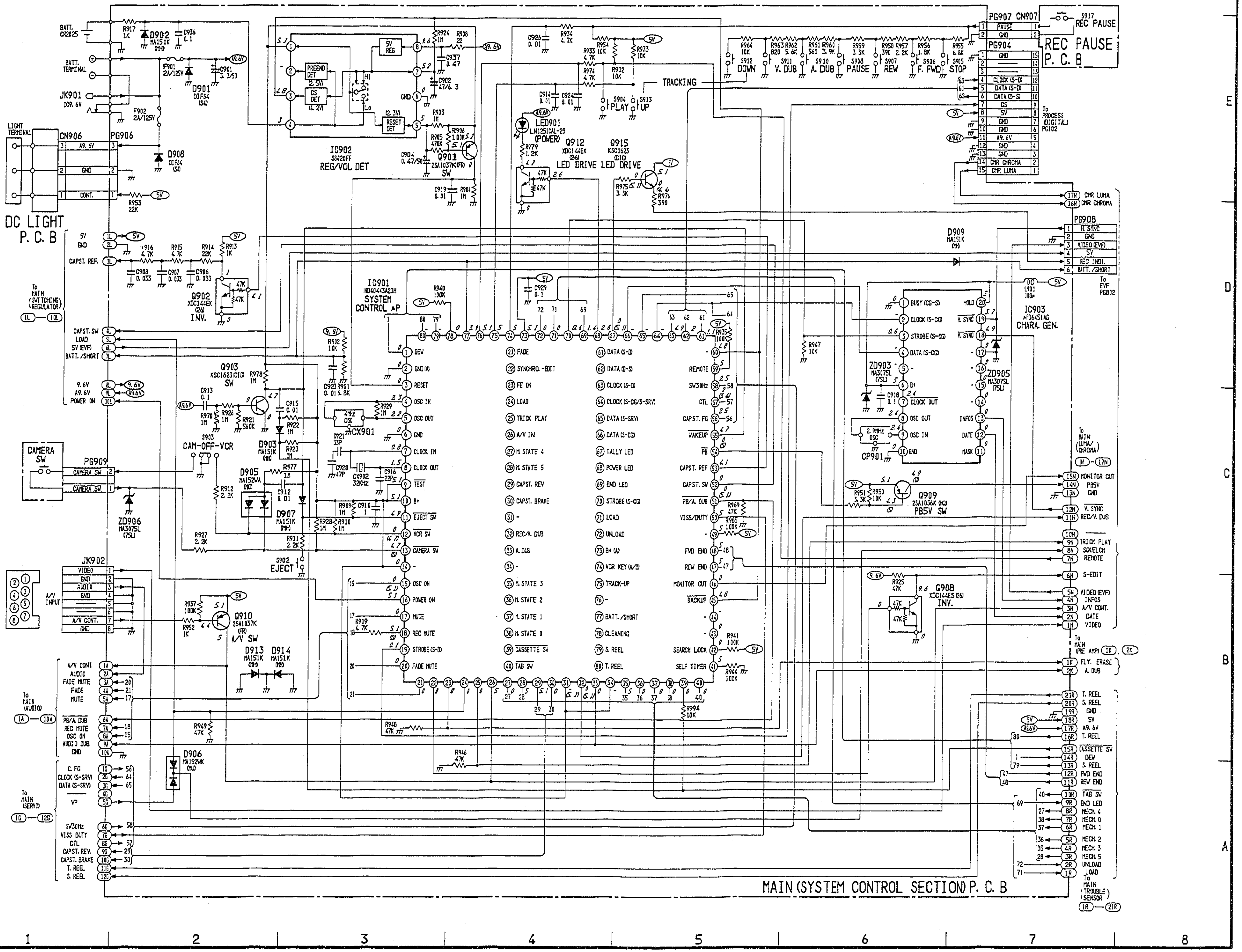
MAIN (SWITCHING REGULATOR SECTION), SWR CONTROL SCHEMATIC DIAGRAM



To MAIN (SERVO) 1D - 5D
A9.6V 5D
B+ (CAPST.) 4D
C. CONT. 3D
GND 2D
5V 1D
To MAIN (SYSTEM CONTROL) 1L - 6L
5V 1L
GND 2L
CAPST. REF 3L
CAPST. SW 4L
LOAD 5L
5V (EVF) 6L
To MAIN (AUDIO) 1C, 2C
A5V 1C
GND 2C
To MAIN (LUMA/CHROMA) 1P - 3P
5V 1P
9.6V 2P
GND 3P
To MAIN (CYL. MOTOR DRIVE) 1H
V. CYL. 1H
To MAIN (SYSTEM CONTROL) 7L - 10L
BATT./SHORT 7L
9.6V 8L
A9.6V 9L
POWER ON 10L
R506 10K
R505 100K
Q507 KSC1623 (CIG) SW
Q506 FMY3 (Y3) SW
R507 12K
R508 5.6K
Q505 FMG2 (G2) CAPST. SW
Q504 FMG2 (G2) CAPST. SW
47K
C507 1
L507 22μ
C509 1
L509 10μ
C508 1
L508 22μ
D502 MA152WA (MO)
Q508 KSC1623 (CIG) SW
R504 220K
C506 1
D501 MA152WA (MO)
R512 220K
R511 18K
R509 56K
R510 22K
Q501 2SB1188R (BCR) 9.6V SW
Q502 2SA1037K (FR) 9.6V SW
R501 18K
R502 18K
R503 4.7K
Q503 FMC2 (C2) POWER SW
22K
MAIN (SWITCHING REGULATOR SECTION) P. C. B
BL501
GND
A5V
5V
B+ (CAPST.)
9.6V
DFB
V.CYL.
9.6V
CR OUT
A9.6V
GND
IC501 HT7305B PWM
5V PWM
CAPST. PWM
SAW GEN.
COMPA.
CYL. PWM
GND
L506 10μ
L505 10μ
C505 10/16
C504 10/16
L504 22μ
D501 DS135D
L503 22μ
C503 10/16
L501 10μ
C501 10/16
L502 10μ
C502 10/16
IC502 HT7304 AMP
GND
※NOTE: MARK "■" IS LEADLESS (DISCRETE) COMPONENT.
SWR CONTROL P. C. B
A
B
C
D
E
1
2
3
4
5
6
7
8

DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM		CIRCUIT BOARD DIAGRAM
AUDIO	5-21	/	5-35
AUTO FOCUS	5-10	/	–
CAPSTAN MOTOR	5-28	/	–
CONTROL	5-10	/	5-9
CYL.MOTOR	5-28	/	5-35
DC LIGHT	5-25	/	5-39
DIGITAL	5-13	/	5-15
EVF	5-19	/	5-19
LUMA/CHROMA	5-33	/	5-35
PRE AMP	5-31	/	5-35
PROCESS	5-11	/	5-15
REC PAUSE	5-26	/	5-40
SENSOR	5-7	/	5-9
SERVO	5-29	/	5-35
SUPPLY END SENSOR	5-20	/	5-39
SWITCHING REG.	5-23	/	5-35
SWR CONTROL	5-24	/	5-40
SYSTEM CONTROL	5-25	/	5-35
TAKE-UP SENSOR	5-20	/	5-39
TROUBLE SENSOR	5-20	/	5-35

MAIN (SYSTEM CONTROL SECTION) SCHEMATIC DIAGRAM



BATT. CR2025
R917 1K
D902 MA151K
C936 0.1
BATT. TERMINAL
F901 2A/125V
C901 3.3/50
D901 DIF54
JK901 DC9.6V
F902 2A/125V
LIGHT TERMINAL
CN906
PG906
A9.6V
GND
CONT.
D908 DIF54
R953 22K
DC LIGHT P.C.B
IC902 S8420FF REG/VOL DET
PREEND DET (2.5V)
CS DET (4.2V)
5V REG
RESET DET (2.3V)
R924 1M
R908 22
C937 0.47
C902 47/6.3
R903 1M
R906 100K
R905 470K
Q901 2SA1037K(FR) SW
C904 0.47/50
C919 0.01
R904 1M
C926 0.01
R934 4.7K
R954 4.7K
R933 10K
R973 10K
R974 4.7K
R932 10K
TRACKING
C914 0.01
C924 0.01
S904 PLAY
S913 UP
LED901 LN125ICAL-23 (POWER)
R979 1.2K
Q912 XDC144EK LED DRIVE
Q915 KSC1623 LED DRIVE
R975 3.3K
R976 390
R964 10K
R963 820
R962 5.6K
R961 560
R960 3.9K
R959 3.3K
R958 390
R957 2.2K
R956 1.8K
R955 6.8K
S912 DOWN
S911 V.DUB
S910 A.DUB
S908 PAUSE
S907 REW
S906 F.FWD
S905 STOP
PG907 CN907
PAUSE
S917 REC PAUSE
REC PAUSE P.C.B
PG904
CLOCK (S-D)
DATA (S-D)
DATA (D-S)
CS
5V
A9.6V
CMR CHROMA
CMR LUMA
To PROCESS (DIGITAL) PG102
PG908
H SYNC
VIDEO (EVF)
REC INDI.
BATT./SHORT
To EVF PG802
D909 MA151K
L901 100μ
IC903 μPD6451AG CHARA. GEN.
BUSY (CG-S)
CLOCK (S-CG)
STROBE (S-CG)
DATA (S-CG)
ZD903 MA3075L
CLOCK OUT
OSC OUT
OSC IN
CP901 2.9MHz OSC
HOLD
H.SYNC
V.SYNC
ZD905 MA3075L
INFOS
DATE
MASK
To MAIN (LUMA/CHROMA) 1N—17N
Q909 2SA1036K PB5V SW
R951 3.3K
R950 18K
MONITOR CUT
PB5V
V.SYNC
REC/V.DUB
TRICK PLAY
SQUELCH
REMOTE
S-EDIT
Q908 XDC144ES INV.
R925 47K
VIDEO (EVF)
INFOS
A/V CONT.
DATE
VIDEO
To MAIN (PRE AMP) 1K, 2K
FLY. ERASE
A.DUB
T.REEL
S.REEL
CASSETTE SW
DEV
FWD END
REW END
TAB SW
END LED
MECH 4
MECH 0
MECH 1
MECH 2
MECH 3
MECH 5
UNLOAD
LOAD
To MAIN (TROUBLE SENSOR) 1R—21R
IC901 HD404423AH SYSTEM CONTROL μP
R940 100K
C929 0.1
DEV
GND (A)
RESET
OSC IN
OSC OUT
GND
CLOCK IN
CLOCK OUT
TEST
B+
EJECT SW
VCR SW
CAMERA SW
OSC ON
POWER ON
MUTE
REC MUTE
STROBE (S-D)
FADE MUTE
FADE
SYNCHRO.-EDIT
FE ON
LOAD
TRICK PLAY
A/V IN
M.STATE 4
M.STATE 5
CAPST. REV
CAPST. BRAKE
REC/V.DUB
A.DUB
M.STATE 3
M.STATE 2
M.STATE 1
M.STATE 0
CASSETTE SW
TAB SW
DATA (S-D)
DATA (D-S)
CLOCK (S-D)
CLOCK (S-CG/S-SRV)
DATA (S-SRV)
DATA (S-CG)
TALLY LED
POWER LED
END LED
STROBE (S-CG)
LOAD
UNLOAD
B+ (A)
VCR KEY (A/D)
TRACK-UP
BATT./SHORT
CLEANING
S.REEL
T.REEL
REMOTE
SW30Hz
CTL
CAPST. FG
WAKEUP
PB
CAPST. REF
CAPST. SW
PB/A.DUB
VISS/DUTY
FWD END
REW END
MONITOR CUT
BACKUP
SEARCH LOCK
SELF TIMER
R935 100K
R947 10K
R969 47K
R965 100K
R941 100K
R944 100K
R994 10K
R948 47K
R946 47K
R902 10K
C923 0.01
R901 6.8K
CX901 4MHz OSC
R929 1M
C921 33P
C920 47P
CX902 32kHz
C916 22P
R909 1M
C910 1
R928 1M
R910 1M
R911 2.2K
S902 EJECT
R919 4.7K
Q903 KSC1623 SW
R978 1M
C913 0.1
R970 1M
R926 1M
R921 560K
C915 0.01
R922 1M
R923 1M
D903 MA151K
S903 CAM-OFF-VCR
D905 MA152WA
R977 1M
C912 0.01
R912 2.2K
D907 MA151K
R927 2.2K
5V
GND
CAPST. REF.
R916 4.7K
R915 4.7K
R914 22K
R913 1K
C908 0.033
C907 0.033
C906 0.033
Q902 XDC144EK INV.
To MAIN (SWITCHING REGULATOR) 1L—10L
CAPST. SW
LOAD
5V (EVF)
BATT./SHORT
9.6V
A9.6V
POWER ON
CAMERA SW
PG909
ZD906 MA3075L
JK902
VIDEO
AUDIO
A/V INPUT
A/V CONT.
Q910 2SA1037K A/V SW
R937 100K
R952 1K
D913 MA151K
D914 MA151K
R949 47K
D906 MA152WK
To MAIN (AUDIO) 1A—10A
A/V CONT.
AUDIO
FADE MUTE
FADE
MUTE
PB/A.DUB
REC MUTE
OSC ON
AUDIO DUB
To MAIN (SERVO) 1G—12G
C.FG
CLOCK (S-SRV)
DATA (S-SRV)
VP
SW30Hz
VISS DUTY
CTL
CAPST. REV.
CAPST. BRAKE
T.REEL
S.REEL
MAIN (SYSTEM CONTROL SECTION) P.C.B
A
B
C
D
E
1
2
3
4
5
6
7
8

SERVO WAVEFORMS

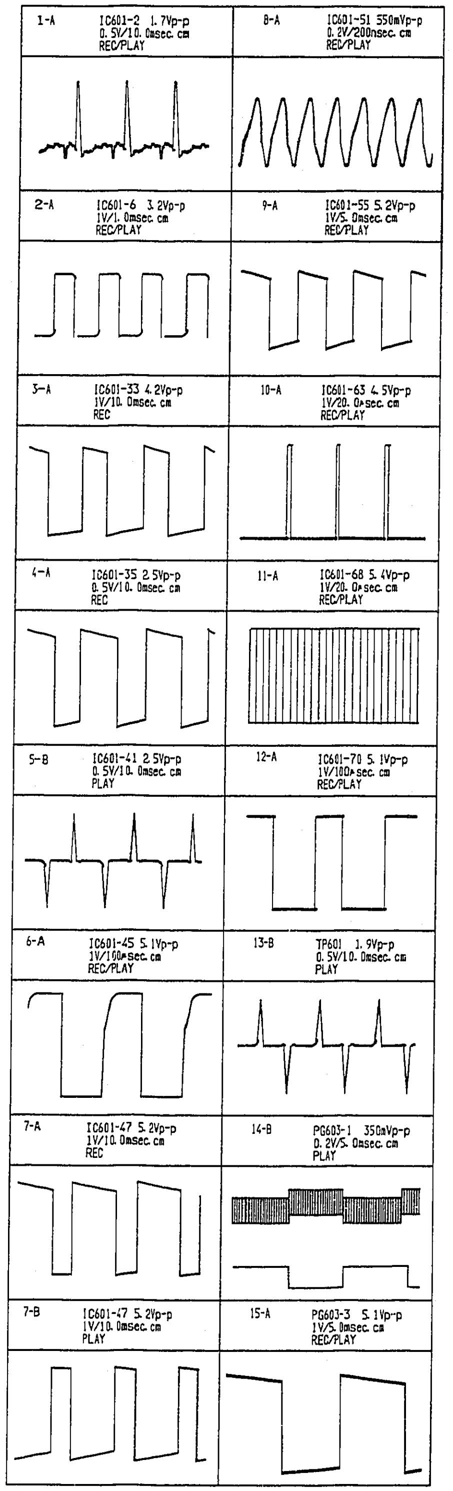
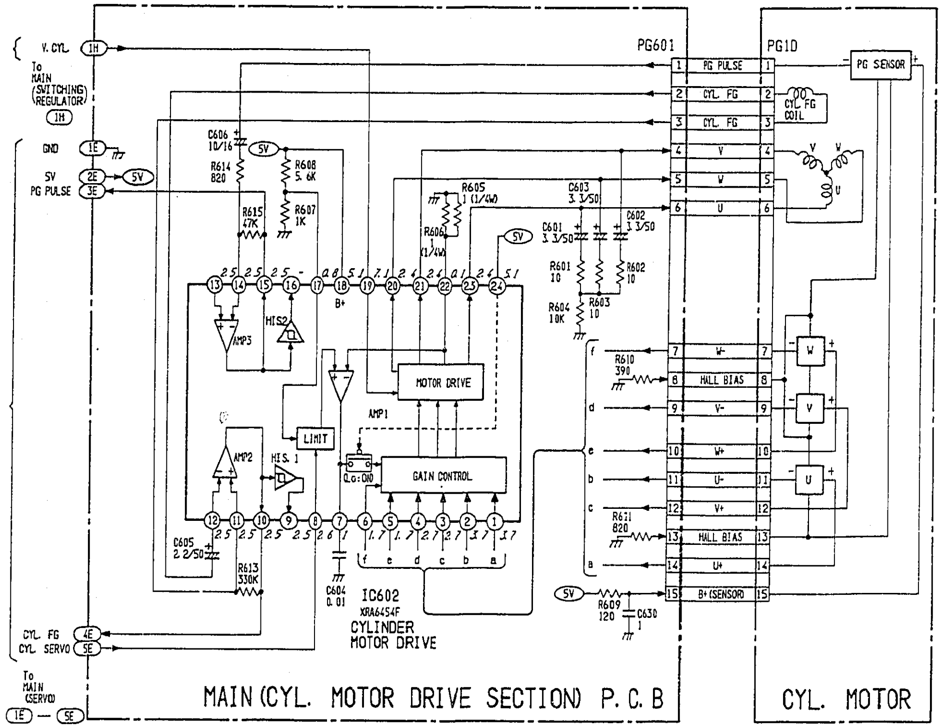
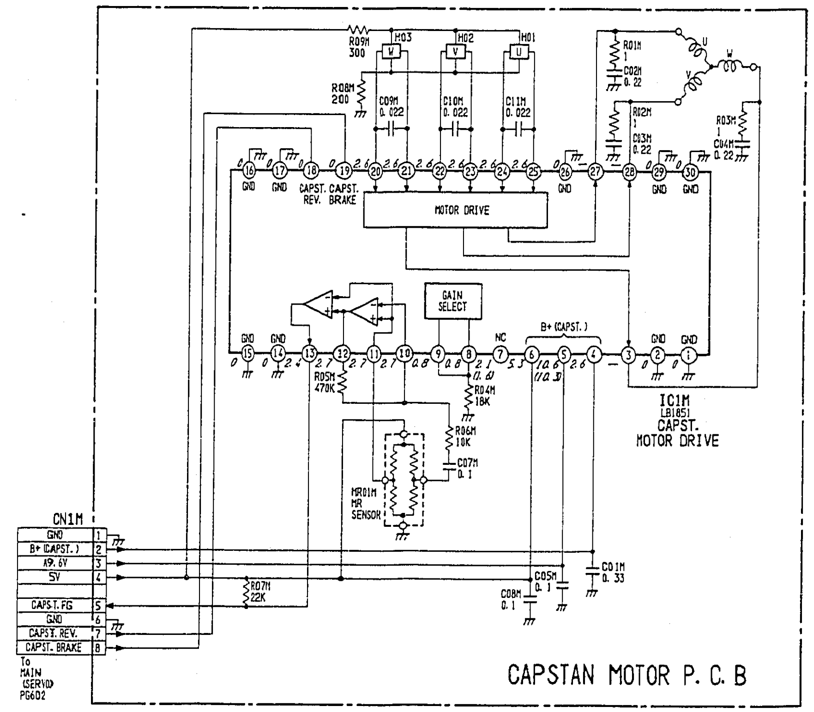


DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM		CIRCUIT BOARD DIAGRAM
AUDIO	5-21	/	5-35
AUTO FOCUS	5-10	/	—
CAPSTAN MOTOR	5-28	/	—
CONTROL	5-10	/	5-9
CYL.MOTOR	5-28	/	5-35
DC LIGHT	5-25	/	5-39
DIGITAL	5-13	/	5-15
EVF	5-19	/	5-19
LUMA/CHROMA	5-33	/	5-35
PRE AMP	5-31	/	5-35
PROCESS	5-11	/	5-15
REC PAUSE	5-26	/	5-40
SENSOR	5-7	/	5-9
SERVO	5-29	/	5-35
SUPPLY END SENSOR	5-20	/	5-39
SWITCHING REG.	5-23	/	5-35
SWR CONTROL	5-24	/	5-40
SYSTEM CONTROL	5-25	/	5-35
TAKE-UP SENSOR	5-20	/	5-39
TROUBLE SENSOR	5-20	/	5-35

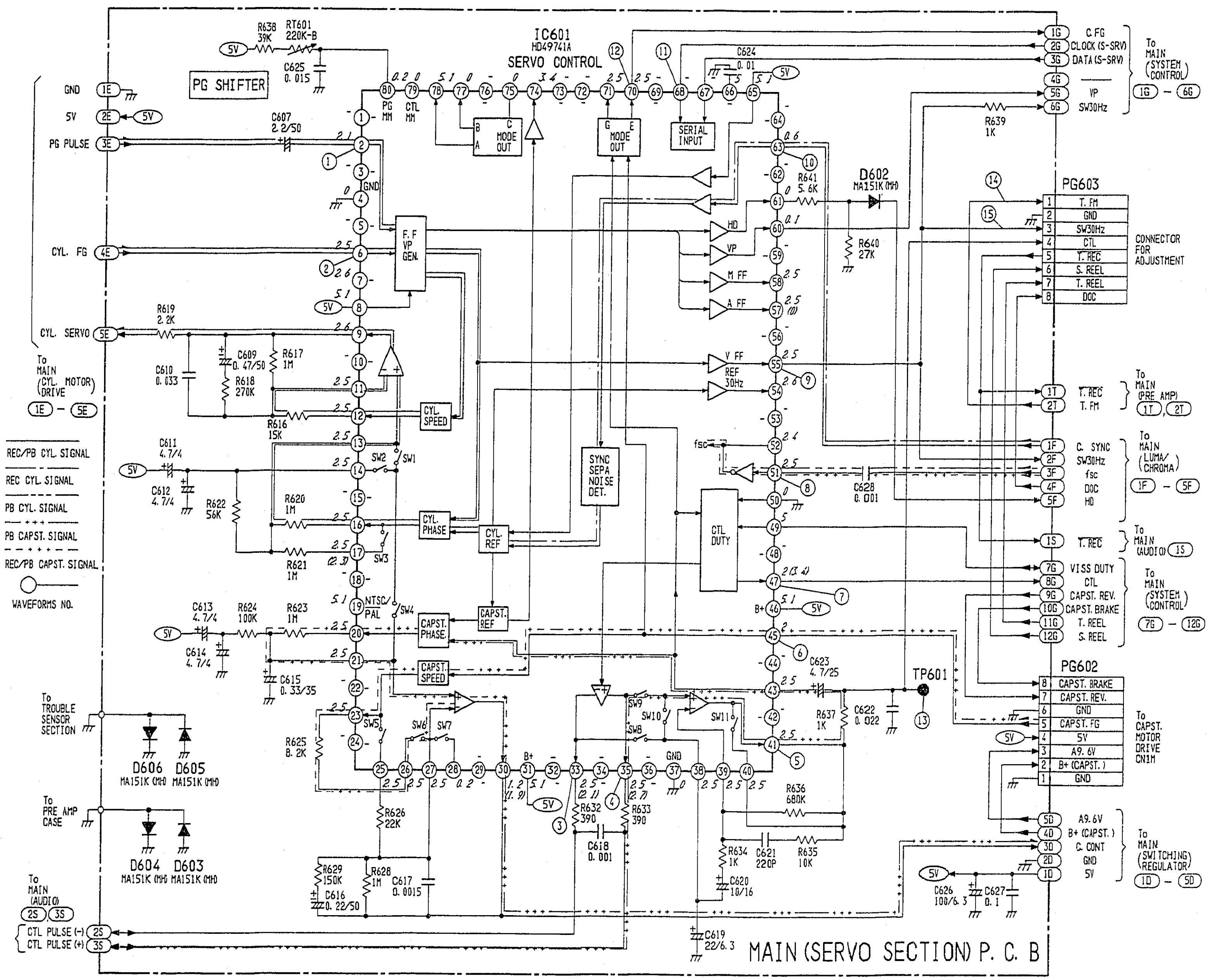
MAIN (CYL. MOTOR DRIVE SECTION) SCHEMATIC DIAGRAM


V.CYL 1H
To MAIN (SWITCHING REGULATOR) 1H
GND 1E
5V 2E
PG PULSE 3E
CYL. FG 4E
CYL. SERVO 5E
To MAIN (SERVO) 1E — 5E
C606 10/16
R614 820
R608 5.6K
R607 1K
R615 47K
R605 1 (1/4W)
R606 1 (1/4W)
C603 3.3/50
C601 3.3/50
C602 3.3/50
R601 10
R602 10
R603 10
R604 10K
AMP3
HIS2
AMP1
AMP2
HIS.1
LIMIT
MOTOR DRIVE
GAIN CONTROL
B+
C605 2.2/50
R613 330K
C604 0.01
IC602 XRA6454F CYLINDER MOTOR DRIVE
R610 390
R611 820
R609 120
C630 1
5V
PG601
PG1D
PG PULSE
CYL. FG
V
W
U
W-
HALL BIAS
V-
W+
U-
V+
U+
B+ (SENSOR)
PG SENSOR
CYL. FG COIL
MAIN (CYL. MOTOR DRIVE SECTION) P.C.B
CYL. MOTOR

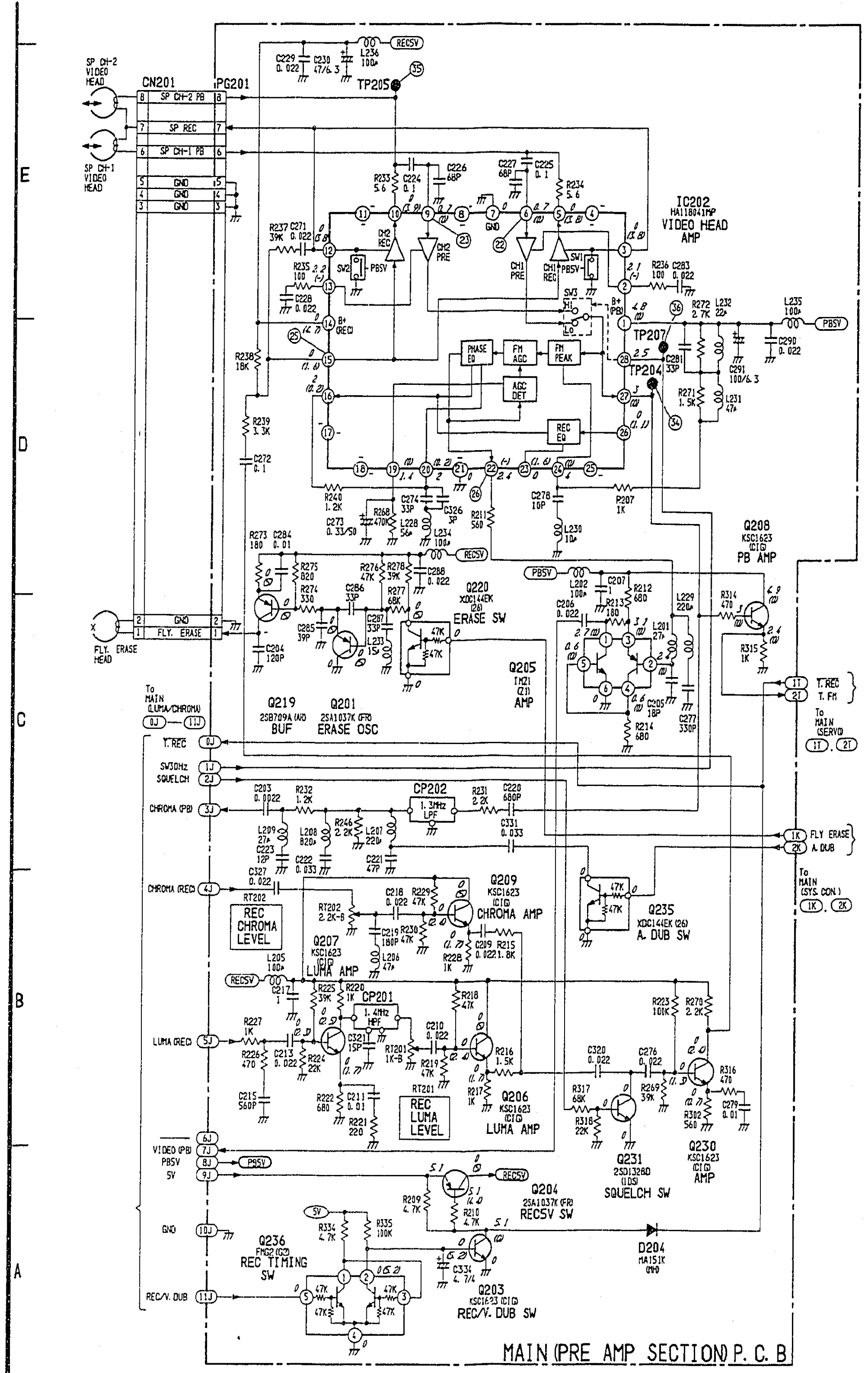
CAPSTAN MOTOR SCHEMATIC DIAGRAM


R09M 300
H03
H02
H01
R08M 200
C09M 0.022
C10M 0.022
C11M 0.022
R01M 1
C02M 0.22
R02M 1
C03M 0.22
R03M 1
C04M 0.22
GND
CAPST. REV.
CAPST. BRAKE
MOTOR DRIVE
GAIN SELECT
NC
B+ (CAPST.)
R05M 470K
R04M 18K
R06M 10K
C07M 0.1
MR01M MR SENSOR
IC1M LB1851 CAPST. MOTOR DRIVE
CN1M
GND
B+ (CAPST.)
A9.6V
5V
CAPST. FG
GND
CAPST. REV.
CAPST. BRAKE
To MAIN (SERVO) PG602
R07M 22K
C08M 0.1
C05M 0.1
C01M 0.33
CAPSTAN MOTOR P.C.B

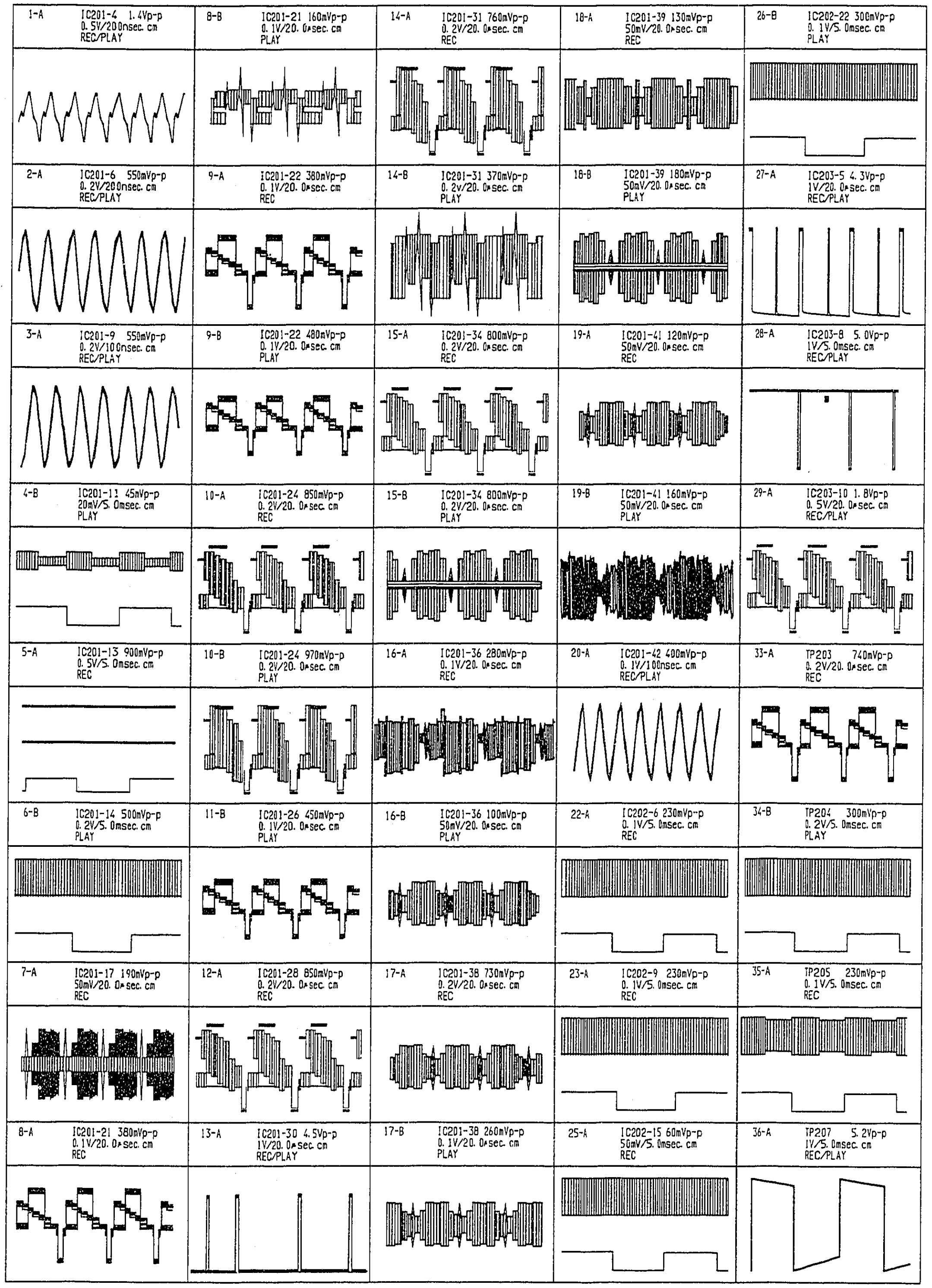
MAIN (SERVO SECTION) SCHEMATIC DIAGRAM


IC601
HD49741A
SERVO CONTROL
PG SHIFTER
R638 39K
RT601 220K-B
C625 0.015
C607 2.2/50
GND
5V
PG PULSE
CYL. FG
CYL. SERVO
To MAIN (CYL. MOTOR DRIVE) 1E - 5E
R619 2.2K
C609 0.47/50
R617 1M
C610 0.033
R618 270K
R616 15K
C611 4.7/4
C612 4.7/4
R622 56K
R620 1M
R621 1M
C613 4.7/4
R624 100K
R623 1M
C614 4.7/4
C615 0.33/35
R625 8.2K
R626 22K
R629 150K
R628 1M
C616 0.22/50
C617 0.0015
REC/PB CYL. SIGNAL
REC CYL. SIGNAL
PB CYL. SIGNAL
PB CAPST. SIGNAL
REC/PB CAPST. SIGNAL
WAVEFORMS NO.
To TROUBLE SENSOR SECTION
D606 MA151K (MH)
D605 MA151K (MH)
To PRE AMP CASE
D604 MA151K (MH)
D603 MA151K (MH)
To MAIN (AUDIO) 2S 3S
CTL PULSE (-)
CTL PULSE (+)
F.F VP GEN.
CYL. SPEED
CYL. PHASE
CYL. REF
CAPST. PHASE
CAPST. REF
CAPST. SPEED
NTSC/PAL
SW1 SW2 SW3 SW4 SW5 SW6 SW7 SW8 SW9 SW10 SW11
MODE OUT
SERIAL INPUT
SYNC SEPA NOISE DET.
CTL DUTY
HD
VP
M FF
A FF
V FF
REF 30Hz
fsc
B+
C624 0.01
R641 5.6K
D602 MA151K (MH)
R640 27K
R639 1K
C628 0.001
C623 4.7/25
R637 1K
C622 0.022
TP601
R632 390
R633 390
C618 0.001
R636 680K
R634 1K
C621 220P
R635 10K
C620 10/16
C619 22/6.3
C626 100/6.3
C627 0.1
C.FG
CLOCK (S-SRV)
DATA (S-SRV)
VP
SW30Hz
To MAIN (SYSTEM CONTROL) 1G - 6G
PG603
T. FM
GND
SW30Hz
CTL
T. REC
S. REEL
T. REEL
DOC
CONNECTOR FOR ADJUSTMENT
T. REC
T. FM
To MAIN (PRE AMP) 1T, 2T
C. SYNC
SW30Hz
fsc
DOC
HD
To MAIN (LUMA/CHROMA) 1F - 5F
T. REC
To MAIN (AUDIO) 1S
VISS DUTY
CTL
CAPST. REV.
CAPST. BRAKE
T. REEL
S. REEL
To MAIN (SYSTEM CONTROL) 7G - 12G
PG602
CAPST. BRAKE
CAPST. REV.
GND
CAPST. FG
5V
A9.6V
B+ (CAPST.)
GND
To CAPST. MOTOR DRIVE CN1M
A9.6V
B+ (CAPST.)
C. CONT
GND
5V
To MAIN (SWITCHING REGULATOR) 1D - 5D
MAIN (SERVO SECTION) P. C. B

MAIN (PRE AMP SECTION) SCHEMATIC DIAGRAM

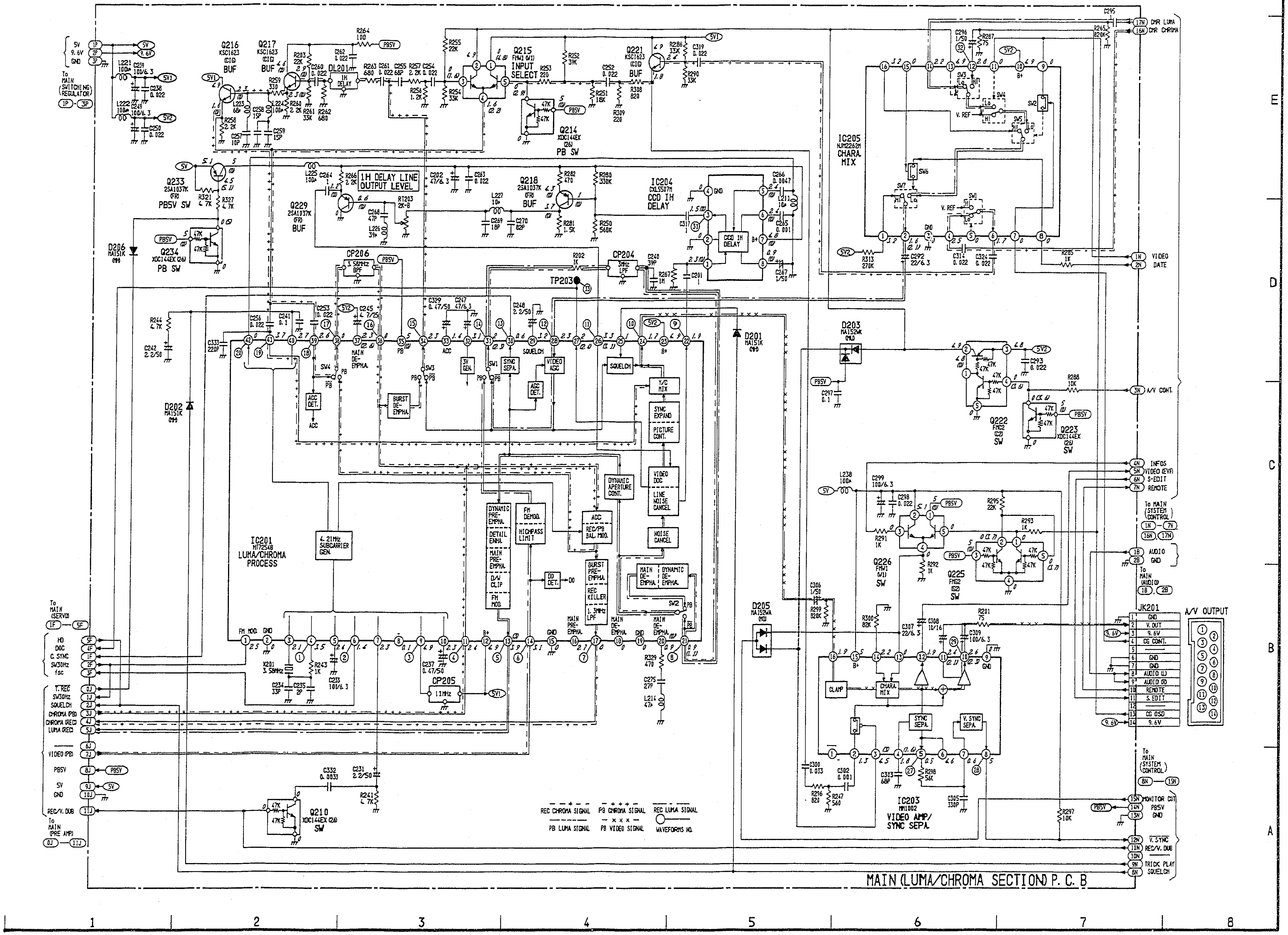

E
D
C
B
A
SP CH-2 VIDEO HEAD
SP CH-1 VIDEO HEAD
CN201
PG201
SP CH-2 PB
SP REC
SP CH-1 PB
GND
FLY. ERASE HEAD
FLY. ERASE
TP205
TP207
TP204
RECSV
PBSV
IC202 HA11804IMP VIDEO HEAD AMP
PHASE EQ
FM AGC
FM PEAK
AGC DET
REC EQ
CH2 REC
CH2 PRE
CH1 PRE
CH1 REC
SW1
SW2
SW3
Q208 KSC1623 (C1G) PB AMP
Q220 XDC144EK (26) ERASE SW
Q205 TM21 (21) AMP
Q219 2SB709A (AR) BUF
Q201 2SA1037K (FR) ERASE OSC
To MAIN (LUMA/CHROMA)
T. REC
SW30Hz
SQUELCH
CHROMA (PB)
CHROMA (REC)
LUMA (REC)
VIDEO (PB)
PBSV
5V
GND
REC/V. DUB
T. REC
T. FM
To MAIN (SERVO)
FLY ERASE
A. DUB
To MAIN (SYS. CON.)
CP202 1.3MHz LPF
CP201 1.4MHz HPF
RT202 REC CHROMA LEVEL
RT201 REC LUMA LEVEL
Q209 KSC1623 (C1G) CHROMA AMP
Q207 KSC1623 LUMA AMP
Q206 KSC1623 (C1G) LUMA AMP
Q235 XDC144EK (26) A. DUB SW
Q231 2SD1328D (1DS) SQUELCH SW
Q230 KSC1623 (C1G) AMP
Q204 2SA1037K (FR) RECSV SW
Q236 FMG2 (G2) REC TIMING SW
Q203 KSC1623 (C1G) REC/V. DUB SW
D204 MA151K
MAIN (PRE AMP SECTION) P. C. B

LUMA/CHROMA WAVEFORMS

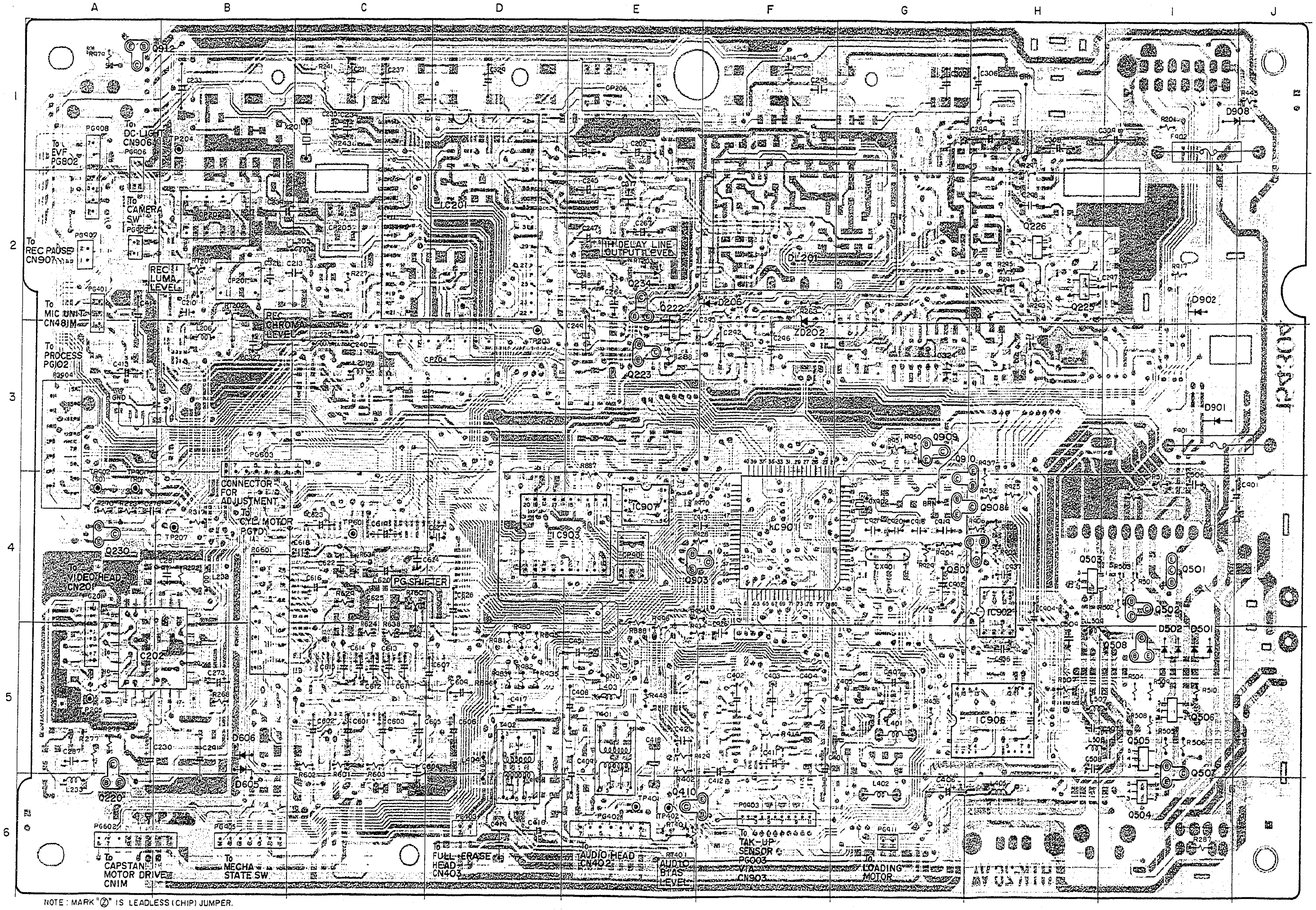


1 2 3 4 5 6 7 8

MAIN (LUMA/CHROMA SECTION) SCHEMATIC DIAGRAM


5V
9.6V
GND
To MAIN (SWITCHING REGULATOR)
Q216 KSC1623 (C1G) BUF
Q217 KSC1623 (C1G) BUF
DL201 1H DELAY
Q215 FMW1 (W1) INPUT SELECT
Q214 XDC144EX (26) PB SW
Q221 KSC1623 (C1G) BUF
Q233 2SA1037K (FR) PB5V SW
Q234 XDC144EX (26) PB SW
D206 MA151K (MH)
1H DELAY LINE OUTPUT LEVEL
Q229 2SA1037K (FR) BUF
Q218 2SA1037K (FR) BUF
IC204 CXL5507M CCD 1H DELAY
CCD 1H DELAY
CP206 3.58MHz BPF
CP204 3MHz LPF
TP203
IC205 NJM2262M CHARA. MIX
D203 MA152WK (MU)
Q222 FMG2 (G2) SW
Q223 XDC144EX (26) SW
D201 MA151K (MH)
D202 MA151K (MH)
IC201 MT7254B LUMA/CHROMA PROCESS
4.21MHz SUBCARRIER GEN.
MAIN DE-EMPHA.
ACC DET.
BURST DE-EMPHA.
SYNC SEPA.
VIDEO AGC
AGC DET.
SQUELCH
Y/C MIX
SYNC EXPAND
PICTURE CONT.
VIDEO DOC
LINE NOISE CANCEL
NOISE CANCEL
DYNAMIC APERTURE CONT.
DYNAMIC PRE-EMPHA.
DETAIL ENHL
MAIN PRE-EMPHA.
D/W CLIP
FM MOD.
FM DEMOD.
HIGHPASS LIMIT
DO DET.
ACC REC/PB BAL MOD.
BURST PRE-EMPHA.
REC KILLER
1.3MHz LPF
MAIN DE-EMPHA.
DYNAMIC DE-EMPHA.
CP205 11MHz
X201 3.58MHz
Q210 XDC144EX (26) SW
D205 MA152WA (MD)
L238 100μ
Q226 FMW1 (W1) SW
Q225 FMG2 (G2) SW
CLAMP
CHARA. MIX
SYNC SEPA.
V. SYNC SEPA.
IC203 MM1002 VIDEO AMP/ SYNC SEPA.
JK201
A/V OUTPUT
To MAIN (SERVO)
HD
DOC
C. SYNC
SW30Hz
fsc
T. REC
SW30Hz
SQUELCH
CHROMA (PB)
CHROMA (REC)
LUMA (REC)
VIDEO (PB)
PB5V
5V
GND
REC/V. DUB
To MAIN (PRE AMP)
CHR LUMA
CHR CHROMA
VIDEO DATE
A/V CONT.
INFOS
VIDEO (EVF)
S-EDIT
REMOTE
To MAIN (SYSTEM CONTROL)
AUDIO
GND
To MAIN (AUDIO)
GND
V. OUT
9.6V
CG CONT.
AUDIO (L)
AUDIO (R)
REMOTE
S.EDIT
CG OSD
MONITOR CUT
PB5V
GND
V. SYNC
REC/V. DUB
TRICK PLAY
SQUELCH
REC CHROMA SIGNAL
PB CHROMA SIGNAL
REC LUMA SIGNAL
PB LUMA SIGNAL
PB VIDEO SIGNAL
WAVEFORMS NO.
MAIN (LUMA/CHROMA SECTION) P. C. B
E
D
C
B
A
1
2
3
4
5
6
7
8

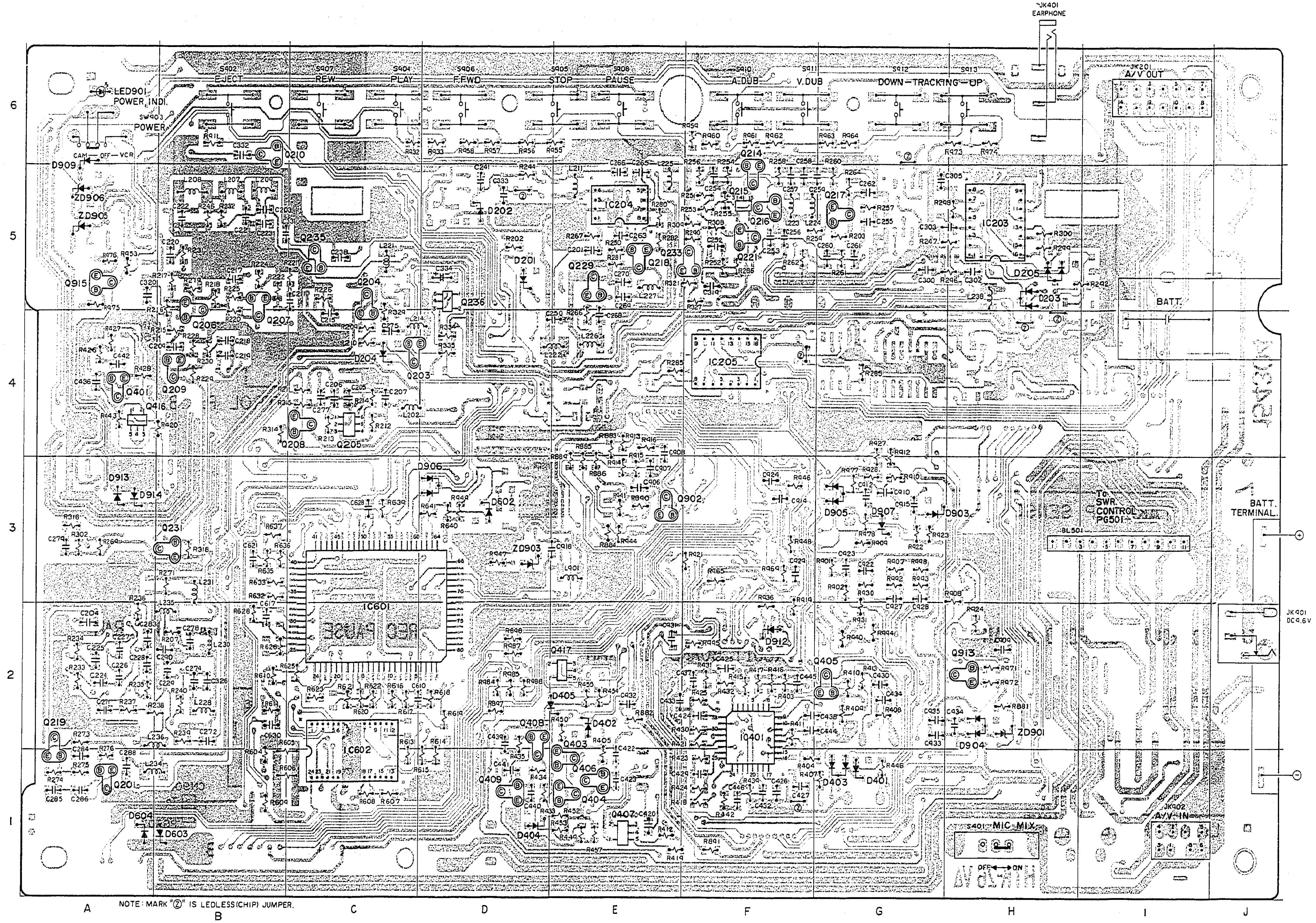
MAIN CIRCUIT BOARD DIAGRAM (COMPONENT SIDE)


A
B
C
D
E
F
G
H
I
J
1
2
3
4
5
6
To EVF PG802
To DC-LIGHT CN906
PG908
PG906
To CAMERA SW
To REC PAUSE CN907
PG907
REC LUMA LEVEL
To MIC UNIT CN481M
To PROCESS PG102
PG401
REC CHROMA LEVEL
1H DELAY LINE OUTPUT LEVEL
LC201
CP205
CP201
CP204
CP206
DL201
Q226
Q225
Q222
Q223
Q234
D206
ZD202
D902
D901
D908
F401
F402
PG603
CONNECTOR FOR ADJUSTMENT
To CYL MOTOR PG701
TP207
Q230
To VIDEO HEAD CN201
PG SHIFTER
IC907
IC903
IC901
IC902
IC906
Q903
Q909
Q910
Q908
Q501
Q502
Q503
Q504
Q505
Q506
Q507
Q508
D501
D502
D605
D606
Q220
Q410
TP401
TP402
To CAPSTAN MOTOR DRIVE CN1M
PG602
PG405
To MECHA STATE SW
To FULL ERASE HEAD CN403
To AUDIO HEAD CN402
PG402
AUDIO BIAS LEVEL
To TAKE-UP SENSOR PG003 VIA CN903
PG903
PG911
To LOADING MOTOR
GND

NOTE : MARK "②" IS LEADLESS (CHIP) JUMPER.

MAIN P.C.B (COMPONENT SIDE)

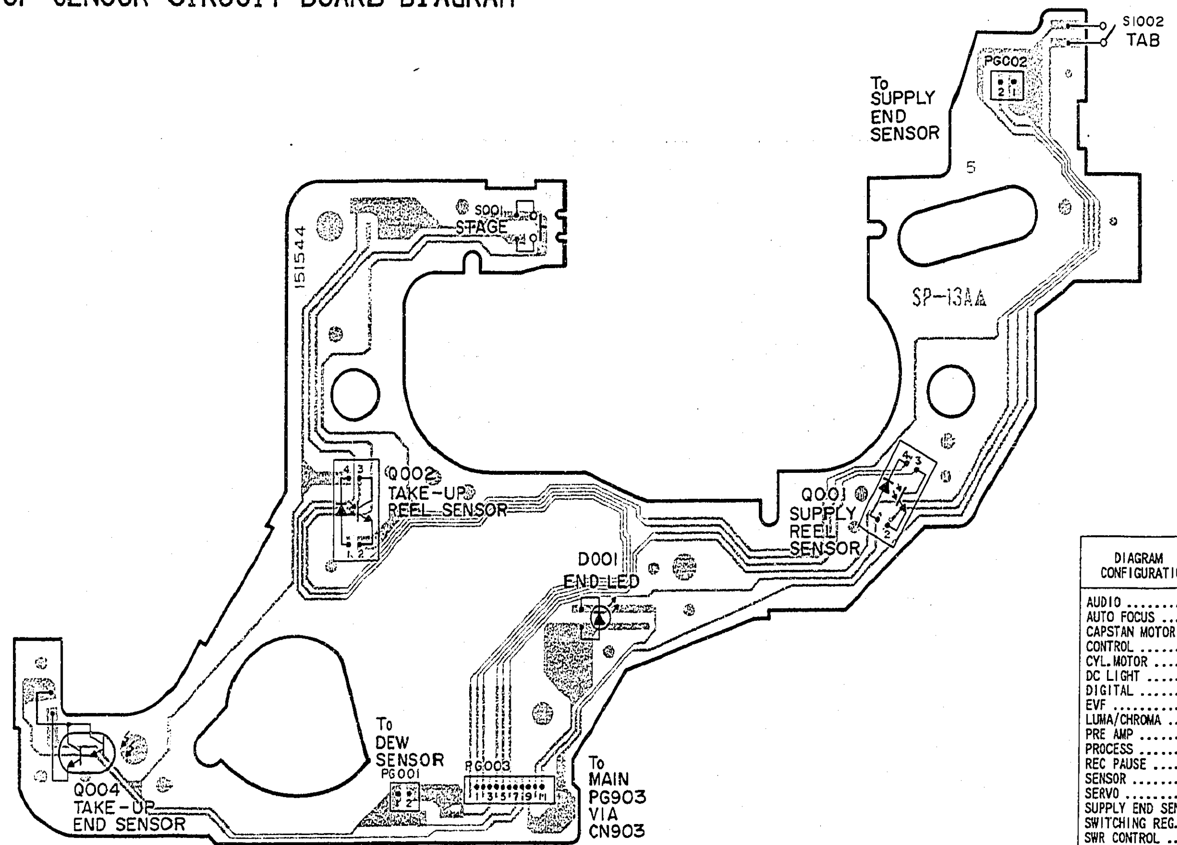
MAIN CIRCUIT BOARD DIAGRAM (SOLDER SIDE)


JK401 EARPHONE
S402 EJECT
S407 REW
S404 PLAY
S406 F.FWD
S405 STOP
S408 PAUSE
S410 A.DUB
S411 V.DUB
S412 DOWN
TRACKING
S413 UP
JK201 A/V OUT
LED901 POWER INDI.
SW903 POWER
CAM OFF VCR
D909
ZD906
ZD905
Q210
Q235
Q236
Q915
Q206
Q207
Q204
Q203
Q401
Q209
Q416
Q208
Q205
D202
D201
D204
IC204
IC203
IC205
Q214
Q215
Q216
Q217
Q221
Q229
Q218
Q233
D205
D203
BATT.
D913
D914
D906
D602
Q231
ZD903
Q902
D905
D907
D903
To SWR CONTROL PG501
BL501
BATT. TERMINAL.
IC601
REC PAUSE
IC602
Q417
D912
Q405
Q913
JK401 DC9.6V
D405
Q408
D402
Q403
Q406
Q409
Q404
Q407
IC401
D403
D401
D904
ZD901
Q219
Q201
D604
D603
D404
S401 MIC MIX
OFF ON
JK402 A/V IN
A
B
C
D
E
F
G
H
I
J
1
2
3
4
5
6

NOTE: MARK "Ⓩ" IS LEDLESS(CHIP) JUMPER.

MAIN P.C.B(SOLDER SIDE)

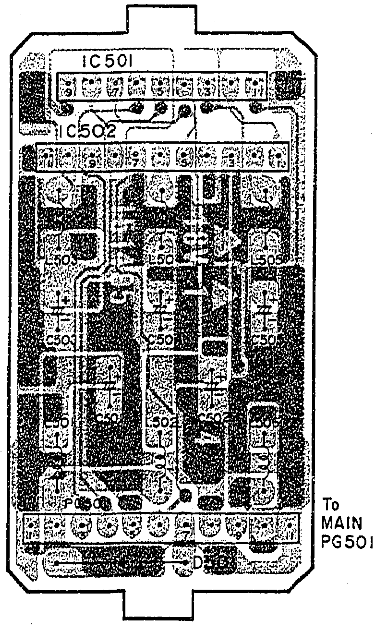
TAKE-UP SENSOR CIRCUIT BOARD DIAGRAM


S1002
TAB
PG002
To
SUPPLY
END
SENSOR
5
SP-13AA
15154
S001
STAGE
Q002
TAKE-UP
REEL SENSOR
Q001
SUPPLY
REEL
SENSOR
D001
END LED
To
DEW
SENSOR
PG001
PG003
To
MAIN
PG903
VIA
CN903
Q004
TAKE-UP
END SENSOR

TAKE-UP SENSOR P.C.B

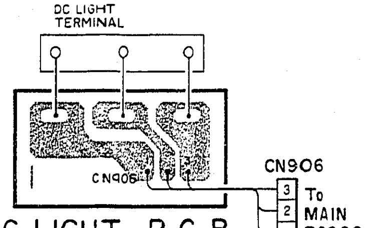
DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM		CIRCUIT BOARD DIAGRAM
AUDIO	5-21	/	5-35
AUTO FOCUS	5-10	/	—
CAPSTAN MOTOR	5-28	/	—
CONTROL	5-10	/	5-9
CYL.MOTOR	5-28	/	5-35
DC LIGHT	5-25	/	5-39
DIGITAL	5-13	/	5-15
EVF	5-19	/	5-19
LUMA/CHROMA	5-33	/	5-35
PRE AMP	5-31	/	5-35
PROCESS	5-11	/	5-15
REC PAUSE	5-26	/	5-40
SENSOR	5-7	/	5-9
SERVO	5-29	/	5-35
SUPPLY END SENSOR	5-20	/	5-39
SWITCHING REG.	5-23	/	5-35
SWR CONTROL	5-24	/	5-40
SYSTEM CONTROL	5-25	/	5-35
TAKE-UP SENSOR	5-20	/	5-39
TROUBLE SENSOR	5-20	/	5-35

SWR CONTROL CIRCUIT BOARD DIAGRAM


IC501
IC502
To
MAIN
PG501

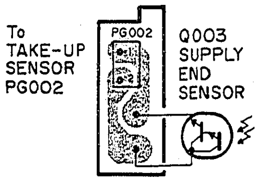
SWR CONTROL P.C.B

DC LIGHT CIRCUIT BOARD DIAGRAM


DC LIGHT
TERMINAL
CN906
CN906
3
2
1
To
MAIN
PG906

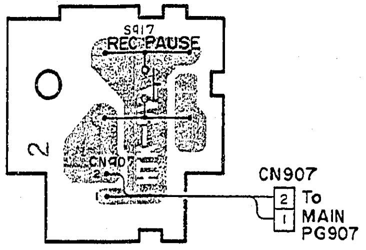
DC LIGHT P.C.B

SUPPLY END SENSOR CIRCUIT BOARD DIAGRAM


To
TAKE-UP
SENSOR
PG002
PG002
Q003
SUPPLY
END
SENSOR

SUPPLY END SENSOR P.C.B

REC PAUSE CIRCUIT BOARD DIAGRAM


S917
REC PAUSE
2
CN907
CN907
2
1
To
MAIN
PG907

REC PAUSE P.C.B

INTERNAL WIRING DIAGRAM -VM-4450A-

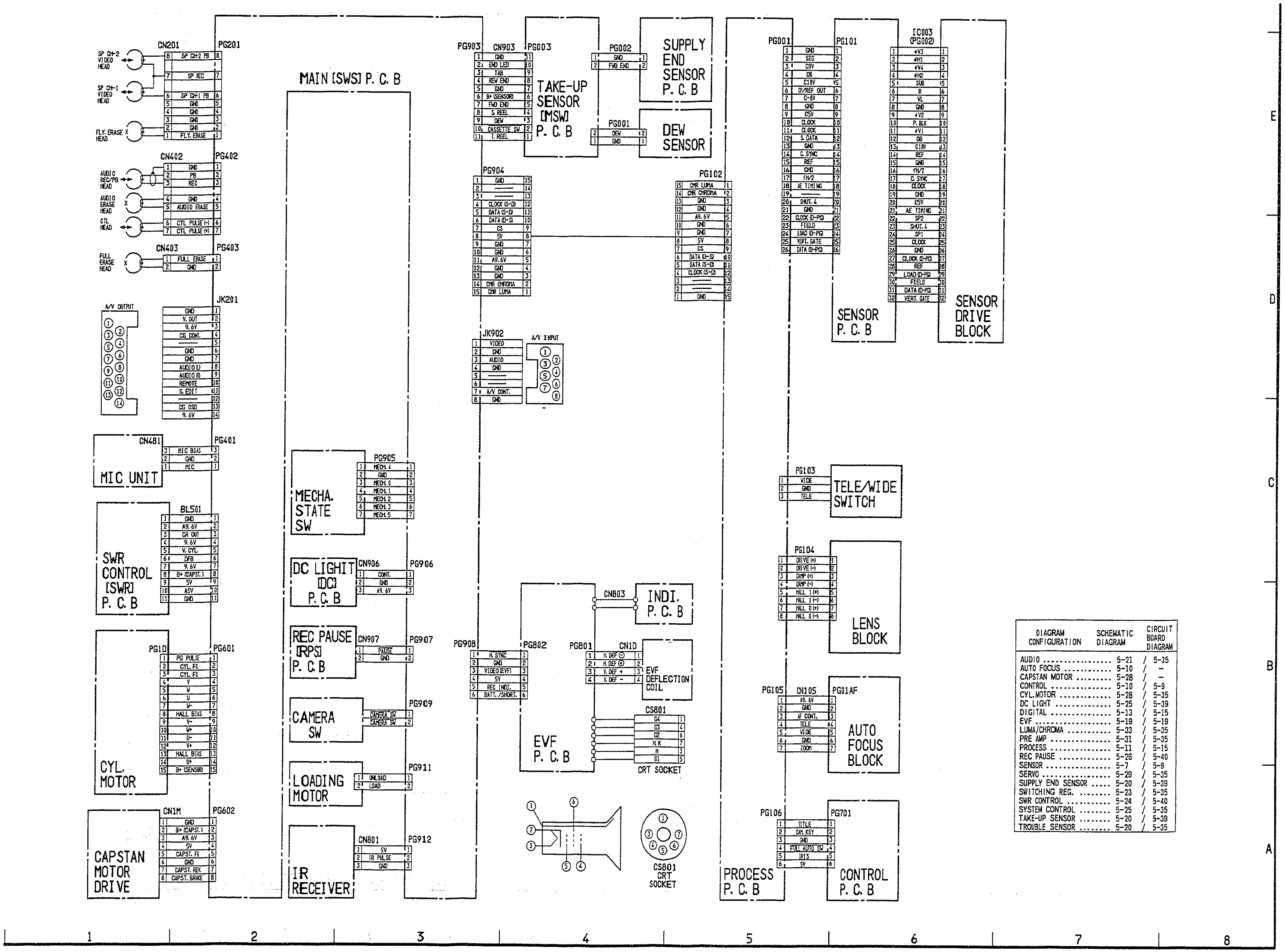
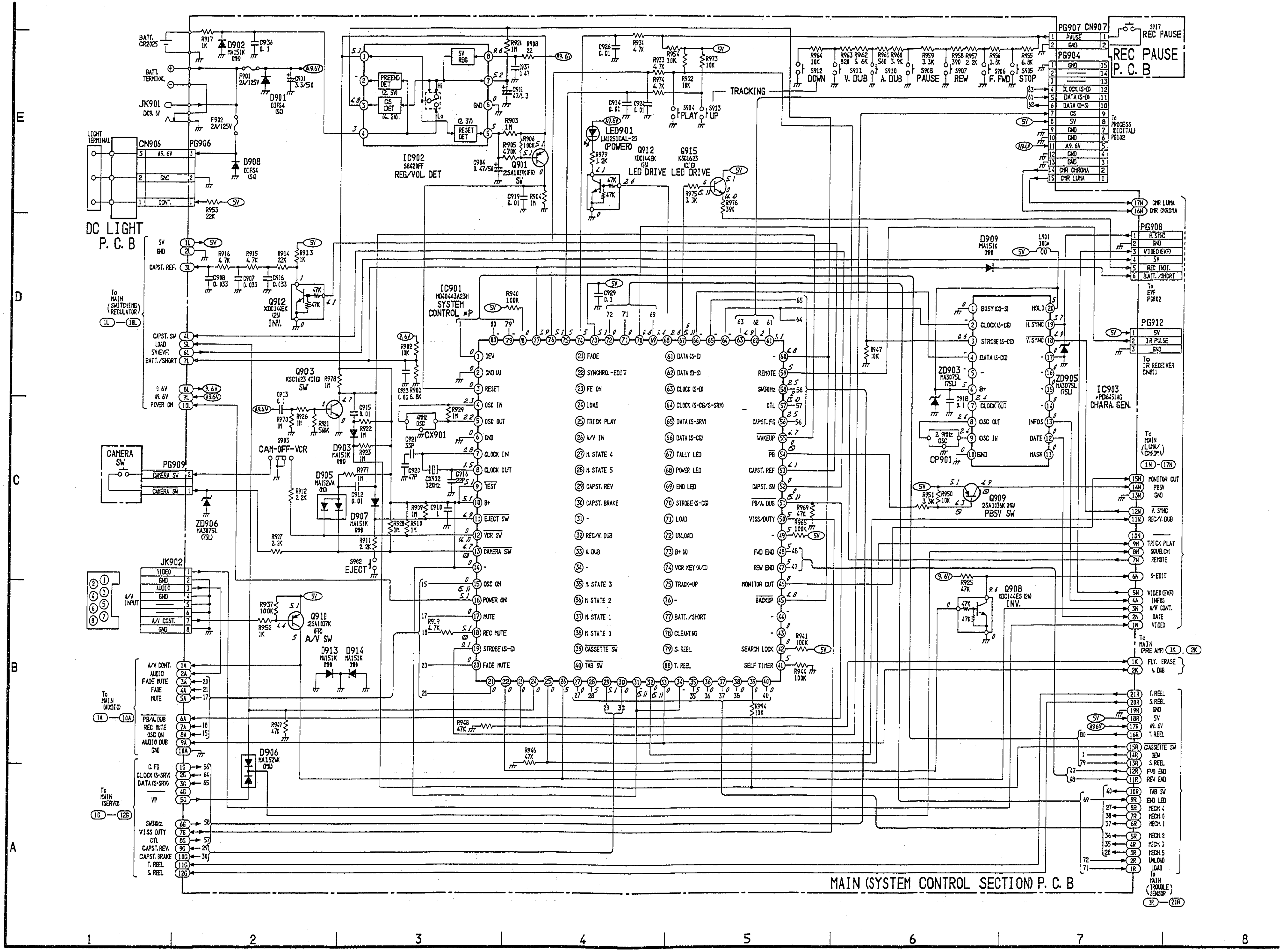

MAIN [SWS] P. C. B
SP CH-2 VIDEO HEAD
SP CH-1 VIDEO HEAD
FLY. ERASE HEAD
AUDIO REC/PB HEAD
AUDIO ERASE HEAD
CTL HEAD
FULL ERASE HEAD
CN201
PG201
CN402
PG402
CN403
PG403
JK201
A/V OUTPUT
CN481
PG401
MIC UNIT
BL501
SWR CONTROL [SWR] P. C. B
PG1D
PG601
CYL. MOTOR
CN1M
PG602
CAPSTAN MOTOR DRIVE
MECHA. STATE SW
PG905
DC LIGHT [DC] P. C. B
CN906
PG906
REC PAUSE [RPS] P. C. B
CN907
PG907
CAMERA SW
PG909
LOADING MOTOR
PG911
IR RECEIVER
CN801
PG912
PG903
CN903
PG003
TAKE-UP SENSOR [MSW] P. C. B
PG002
SUPPLY END SENSOR P. C. B
PG001
DEW SENSOR
PG904
PG102
JK902
A/V INPUT
PG908
PG802
PG801
CN1D
EVF DEFLECTION COIL
CN803
INDI. P. C. B
EVF P. C. B
CS801
CRT SOCKET
CS801 CRT SOCKET
PG001
PG101
IC003 (PG002)
SENSOR P. C. B
SENSOR DRIVE BLOCK
PG103
TELE/WIDE SWITCH
PG104
LENS BLOCK
PG105
CN105
PG01AF
AUTO FOCUS BLOCK
PG106
PG701
PROCESS P. C. B
CONTROL P. C. B
1
2
3
4
5
6
7
8
A
B
C
D
E

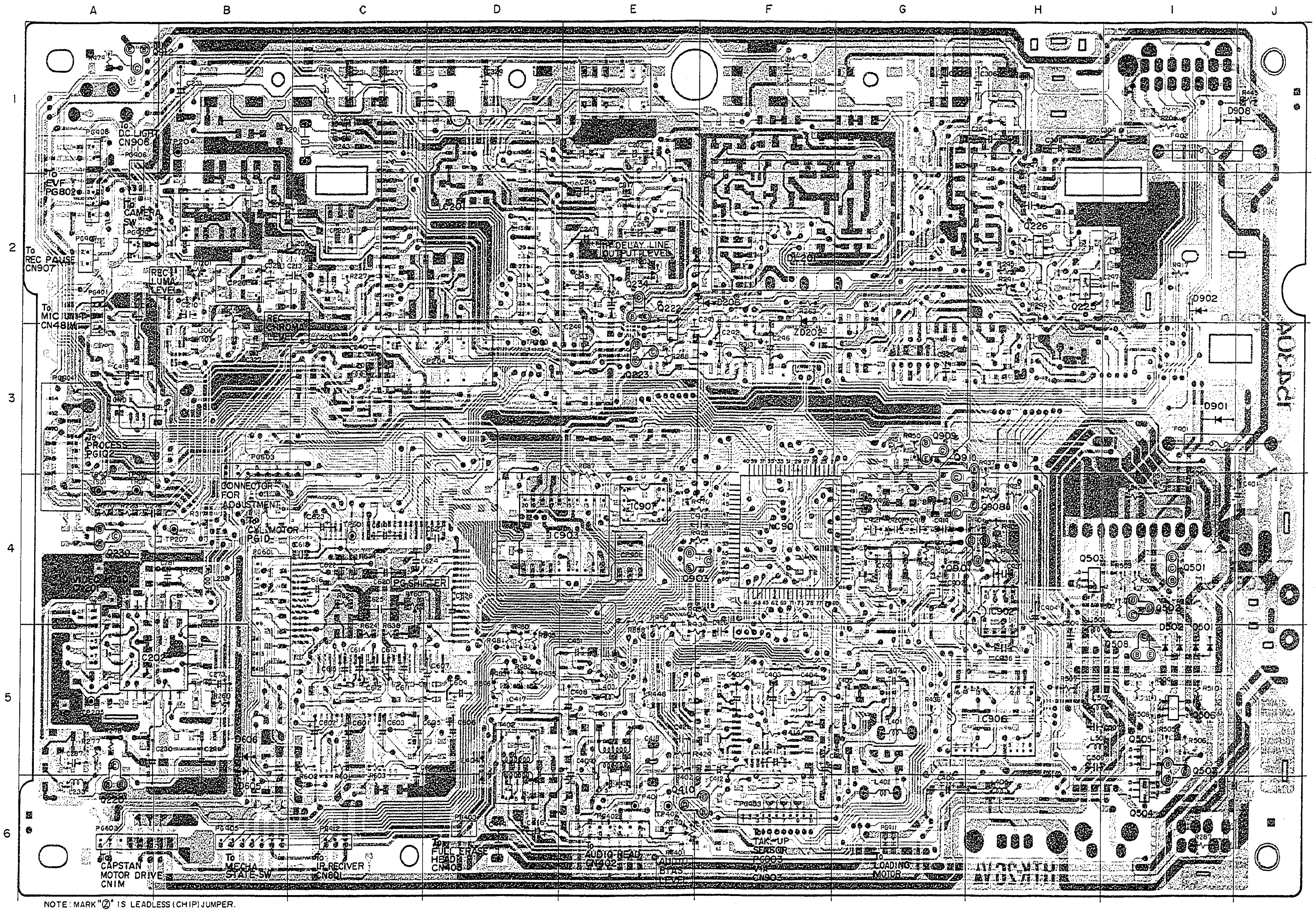
DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM	CIRCUIT BOARD DIAGRAM
AUDIO	5-21	/ 5-35
AUTO FOCUS	5-10	/ –
CAPSTAN MOTOR	5-28	/ –
CONTROL	5-10	/ 5-9
CYL.MOTOR	5-28	/ 5-35
DC LIGHT	5-25	/ 5-39
DIGITAL	5-13	/ 5-15
EVF	5-19	/ 5-19
LUMA/CHROMA	5-33	/ 5-35
PRE AMP	5-31	/ 5-35
PROCESS	5-11	/ 5-15
REC PAUSE	5-26	/ 5-40
SENSOR	5-7	/ 5-9
SERVO	5-29	/ 5-35
SUPPLY END SENSOR	5-20	/ 5-39
SWITCHING REG.	5-23	/ 5-35
SWR CONTROL	5-24	/ 5-40
SYSTEM CONTROL	5-25	/ 5-35
TAKE-UP SENSOR	5-20	/ 5-39
TROUBLE SENSOR	5-20	/ 5-35

MAIN (SYSTEM CONTROL SECTION) SCHEMATIC DIAGRAM -VM-4450A-



BATT. CR2025
BATT. TERMINAL
JK901 DC9.6V
F901 2A/125V
F902 2A/125V
D901 D1FS4
D902 MA151K
D908 D1FS4
CN906
PG906
A9.6V
GND
CONT.
DC LIGHT P.C.B
IC902 S8420FF REG/VOL DET
PREDRIVE DET
CS DET
5V REG
RESET DET
Q901 2SA1037K(FR) SW
R926
R908
LED901 LN1251CAL-23 (POWER)
Q912 XDC144EK INV
Q915 KSC1623 LED DRIVE
LED DRIVE
TRACKING
S904 PLAY
S913 UP
S912 DOWN
S911 V. DUB
S910 A. DUB
S908 PAUSE
S907 REW
S906 F. FWD
S905 STOP
PG907 CN907
S917 REC PAUSE
REC PAUSE P.C.B
PG904
To PROCESS (DIGITAL) PG102
To MAIN (SWITCHING REGULATOR)
CAPST. REF.
Q902 XDC144EK INV.
CAPST. SW
LOAD
5V(EVF)
BATT./SHORT
9.6V
A9.6V
POWER ON
Q903 KSC1623 SW
S903 CAM-OFF-VCR
D903 MA151K
D905 MA152WA
D907 MA151K
CAMERA SW
PG909
ZD906 MA3075L
S902 EJECT
JK902
A/V INPUT
VIDEO
AUDIO
A/V CONT.
Q910 2SA1037K A/V SW
D913 MA151K
D914 MA151K
D906 MA152WK
To MAIN (AUDIO)
To MAIN (SERVO)
IC901 MN04443A23H SYSTEM CONTROL µP
CX901 4MHz OSC
CX902 32kHz
DEW
GND (A)
RESET
OSC IN
OSC OUT
GND
CLOCK IN
CLOCK OUT
TEST
B+
EJECT SW
VCR SW
CAMERA SW
OSC ON
POWER ON
MUTE
REC MUTE
STROBE (S-D)
FADE MUTE
FADE
SYNCHRO.-EDIT
FE ON
LOAD
TRICK PLAY
A/V IN
M. STATE 4
M. STATE 5
CAPST. REV
CAPST. BRAKE
REC/V. DUB
A. DUB
M. STATE 3
M. STATE 2
M. STATE 1
M. STATE 0
CASSETTE SW
TAB SW
DATA (S-D)
DATA (D-S)
CLOCK (S-D)
CLOCK (S-CG/S-SRV)
DATA (S-SRV)
DATA (S-CG)
TALLY LED
POWER LED
END LED
STROBE (S-CG)
UNLOAD
B+ (A)
VCR KEY (A/D)
TRACK-UP
BATT./SHORT
CLEANING
S. REEL
T. REEL
REMOTE
SW30Hz
CTL
CAPST. FG
WAKEUP
PB
CAPST. REF
CAPST. SW
PB/A. DUB
VISS/DUTY
FWD END
REW END
MONITOR OUT
BACKUP
SEARCH LOCK
SELF TIMER
D909 MA151K
L901
PG908
H. SYNC
VIDEO (EVF)
REC INDI.
BATT./SHORT
To EVF PG802
PG912
IR PULSE
To IR RECEIVER CN801
IC903 µPD6451AG CHARA. GEN.
BUSY (CG-S)
CLOCK (S-CG)
STROBE (S-CG)
DATA (S-CG)
HOLD
V. SYNC
CLOCK OUT
INFOS
DATE
MASK
ZD903 MA3075L
ZD905 MA3075L
CP901 2.9MHz OSC
Q909 2SA1036K PB5V SW
Q908 XDC144ES INV.
To MAIN (LUMA/CHROMA)
MONITOR OUT
PB5V
V. SYNC
REC/V. DUB
TRICK PLAY
SQUELCH
REMOTE
S-EDIT
VIDEO (EVF)
A/V CONT.
To MAIN (PRE AMP)
FLY. ERASE
A. DUB
T. REEL
S. REEL
CASSETTE SW
DEW
FWD END
REW END
TAB SW
END LED
MECH 4
MECH 0
MECH 1
MECH 2
MECH 3
MECH 5
UNLOAD
LOAD
To MAIN (TROUBLE SENSOR)
MAIN (SYSTEM CONTROL SECTION) P.C.B
A
B
C
D
E
1
2
3
4
5
6
7
8

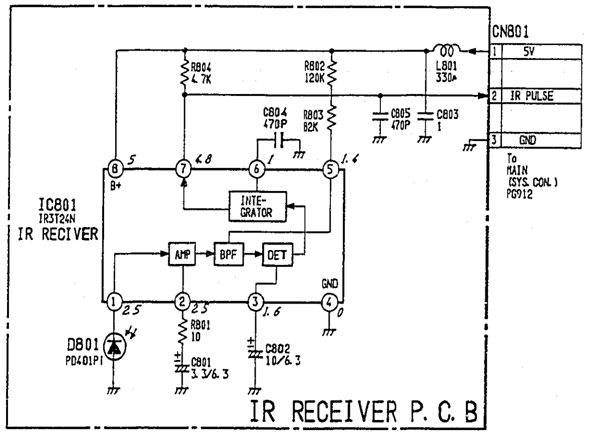
MAIN CIRCUIT BOARD DIAGRAM (COMPONENT SIDE) -VM-4450A-


A
B
C
D
E
F
G
H
I
J
1
2
3
4
5
6
To EVF PG802
To DC LIGHT CN906
To CAMERA SW
To REC PAUSE CN907
To MIC CN481M
REC LUMA LEVEL
REC CHROMA LEVEL
RF DELAY LINE OUTPUT LEVEL
To PROCESS PG102
CONNECTOR FOR ADJUSTMENT
To CYL MOTOR PG610
PG SHIFTER
IC901
IC903
IC902
IC906
Q226
Q225
Q222
Q223
Q230
Q220
Q410
Q501
Q503
Q504
Q505
Q506
Q903
Q909
Q910
D901
D902
D906
D501
D502
D508
ZD202
To CAPSTAN MOTOR DRIVE CN1M
To MECHA STATE SW
To IR RECIVER CN801
To FULL ERASE HEAD CN405
To AUDIO HEAD CN402
BIAS LEVEL
TAK-UP SENSOR CN903
To LOADING MOTOR

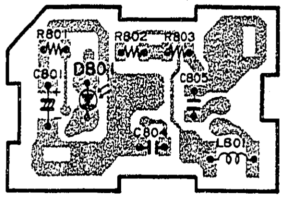
NOTE: MARK "②" IS LEADLESS (CHIP) JUMPER.

MAIN P.C.B(COMPONENT SIDE)

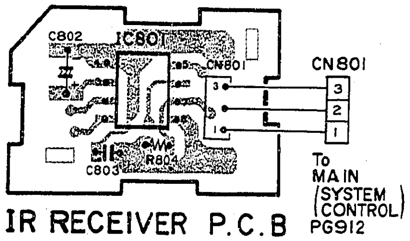
IR RECEIVER SCHEMATIC DIAGRAM


CN801
1 5V
2 IR PULSE
3 GND
To MAIN (SYS. CON.) PG912
L801 330μ
R804 4.7K
R802 120K
C804 470P
R803 82K
C805 470P
C803 1
8 5 B+
7 4.8
6 1
5 1.4
IC801 IR3T24N IR RECIVER
INTE-GRATOR
AMP
BPF
DET
GND
1 2.5
2 2.5
3 1.6
4 0
D801 PD401P1
R801 10
C801 3.3/6.3
C802 10/6.3
IR RECEIVER P.C.B

IR RECEIVER CIRCUIT BOARD DIAGRAM


R801
R802
R803
C801
D801
C805
C804
L801

IR RECEIVER P.C.B
(SIDE A)

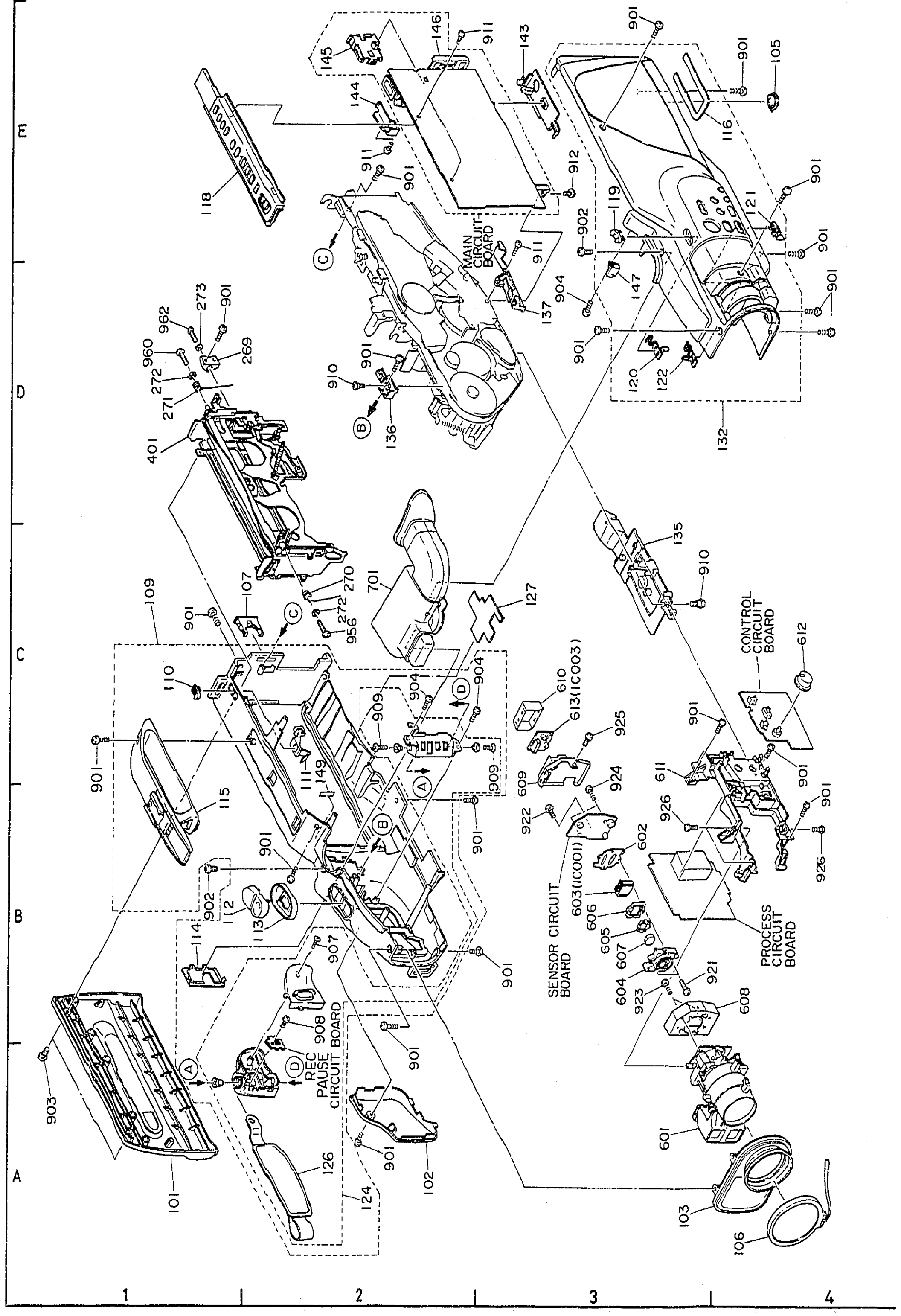

C802
IC801
CN801
3
2
1
C803
R804
CN801
3
2
1
To MAIN (SYSTEM CONTROL) PG912

IR RECEIVER P.C.B
(SIDE B)

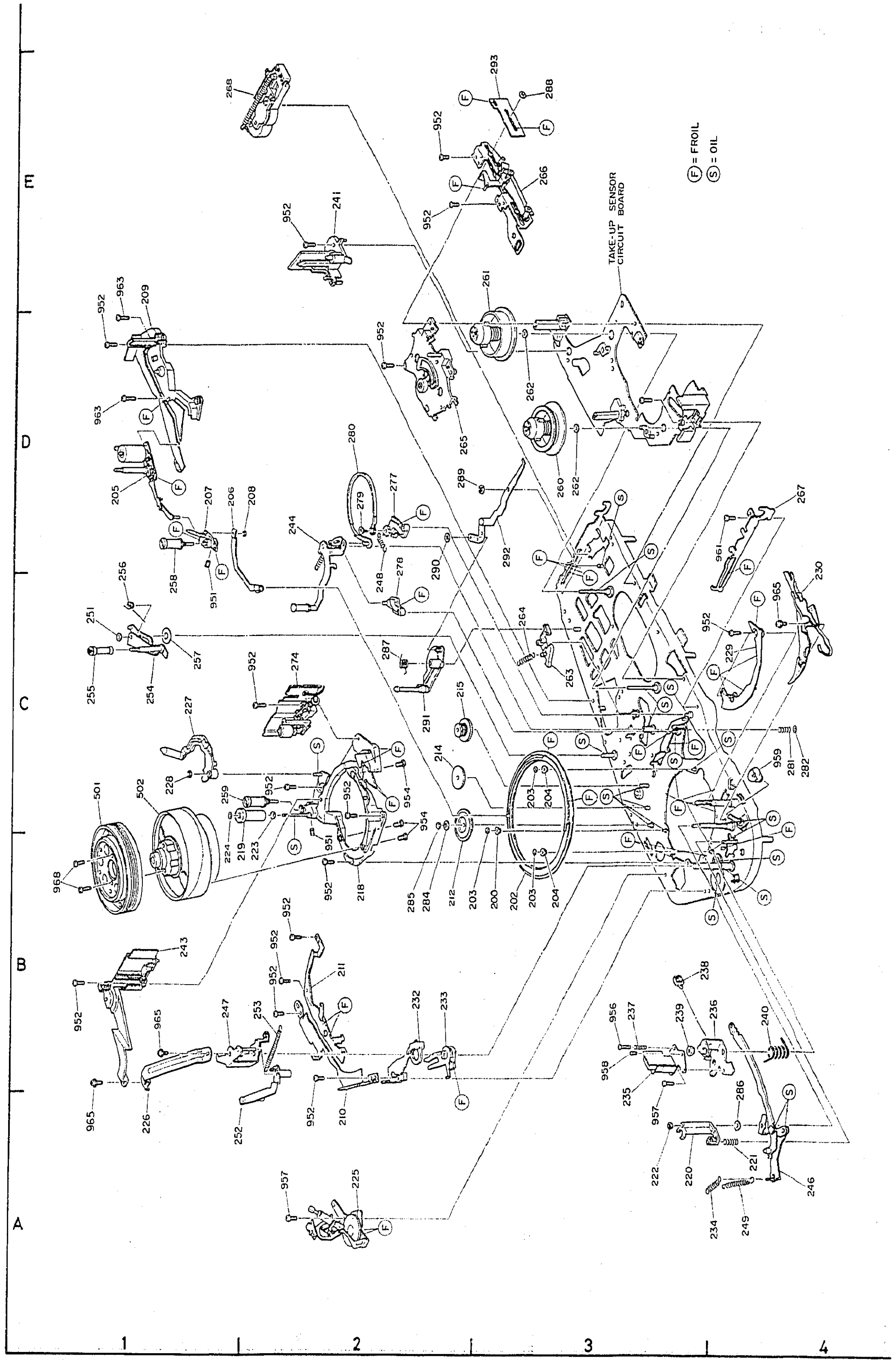
DIAGRAM CONFIGURATION	SCHEMATIC DIAGRAM		CIRCUIT BOARD DIAGRAM
AUDIO	5-21	/	5-35
AUTO FOCUS	5-10	/	—
CAPSTAN MOTOR	5-28	/	—
CONTROL	5-10	/	5-9
CYL.MOTOR	5-28	/	5-35
DC LIGHT	5-25	/	5-39
DIGITAL	5-13	/	5-15
EVF	5-19	/	5-19
LUMA/CHROMA	5-33	/	5-35
PRE AMP	5-31	/	5-35
PROCESS	5-11	/	5-15
REC PAUSE	5-26	/	5-40
SENSOR	5-7	/	5-9
SERVO	5-29	/	5-35
SUPPLY END SENSOR	5-20	/	5-39
SWITCHING REG.	5-23	/	5-35
SWR CONTROL	5-24	/	5-40
SYSTEM CONTROL	5-25	/	5-35
TAKE-UP SENSOR	5-20	/	5-39
TROUBLE SENSOR	5-20	/	5-35

CHAPTER 6 EXPLODED VIEW

CABINET SECTION


E
D
C
B
A
1
2
3
4
145
146
911
143
901
105
144
118
911
901
912
116
901
MAIN CIRCUIT BOARD
911
902
119
121
901
C
904
147
137
901
120
122
132
910
136
B
901
962
273
901
960
272
271
269
401
109
107
C
270
272
956
701
127
135
910
CONTROL CIRCUIT BOARD
612
110
901
904
D
904
909
610
613(IC003)
925
901
611
901
115
111
149
A
909
609
924
922
926
901
B
901
901
902
112
113
SENSOR CIRCUIT BOARD
603(IC001)
602
606
605
607
604
923
921
608
PROCESS CIRCUIT BOARD
926
114
907
901
908
REC PAUSE CIRCUIT BOARD
D
A
903
901
126
124
102
101
601
103
106

CHASSIS (UPPER) SECTION


E
D
C
B
A
1
2
3
4
268
293
288
952
266
241
TAKE-UP SENSOR CIRCUIT BOARD
Ⓕ = FROIL
Ⓢ = OIL
261
262
260
265
952
963
209
205
207
206
208
258
951
280
279
277
278
248
244
299
292
290
256
251
255
254
257
287
264
263
291
215
214
274
227
228
259
224
219
223
501
502
968
218
285
284
212
203
200
202
204
954
267
961
230
965
229
959
281
282
243
247
253
211
232
233
226
252
210
225
957
238
236
237
956
239
240
958
235
286
221
222
220
246
234
249
Ⓕ
Ⓢ

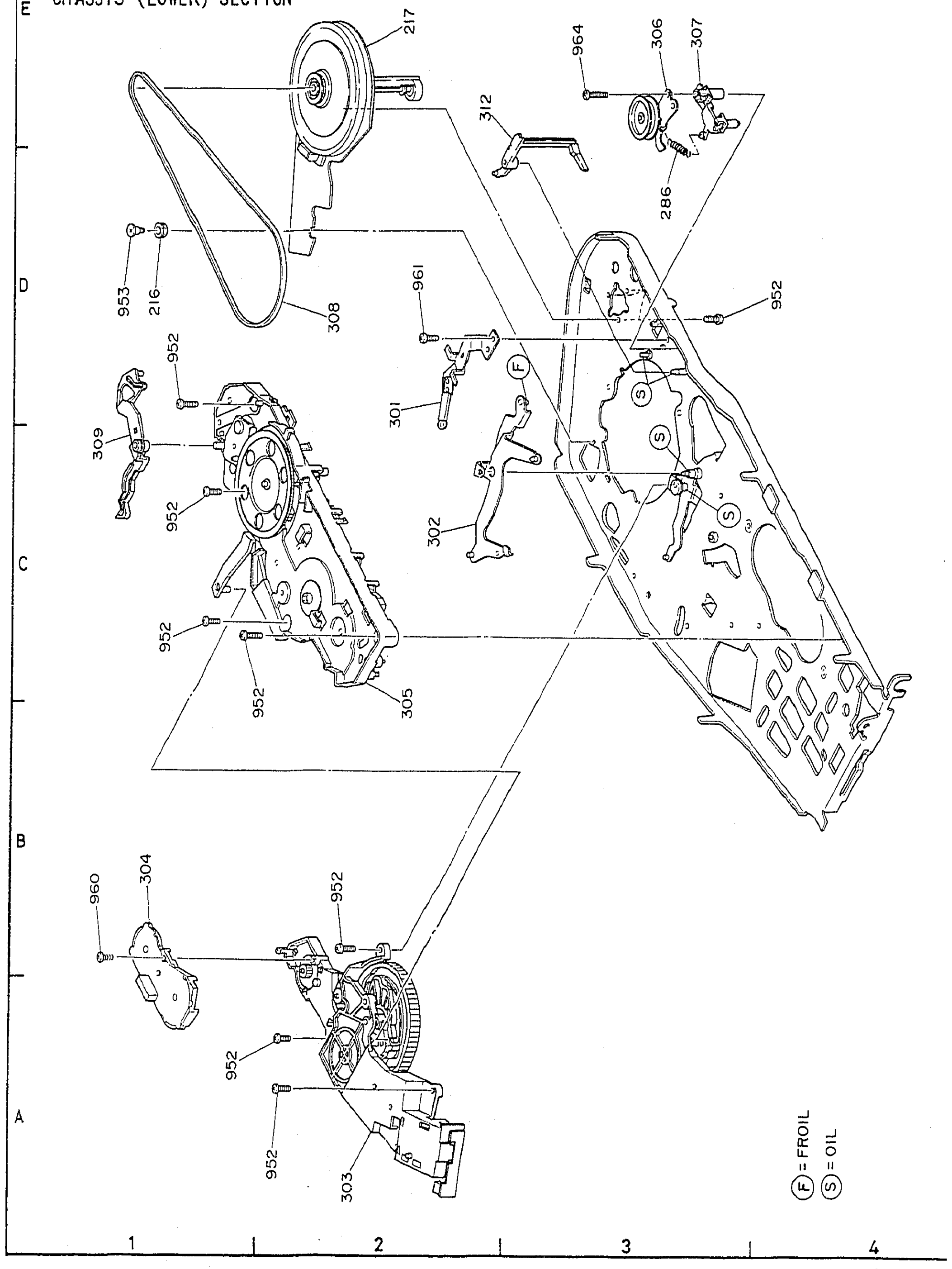
LUBLICATION

Lubrication points are shown in the exploded view diagrams by marks (Ⓢ, Ⓕ).
Lubricants shown in the diagram are as follows.

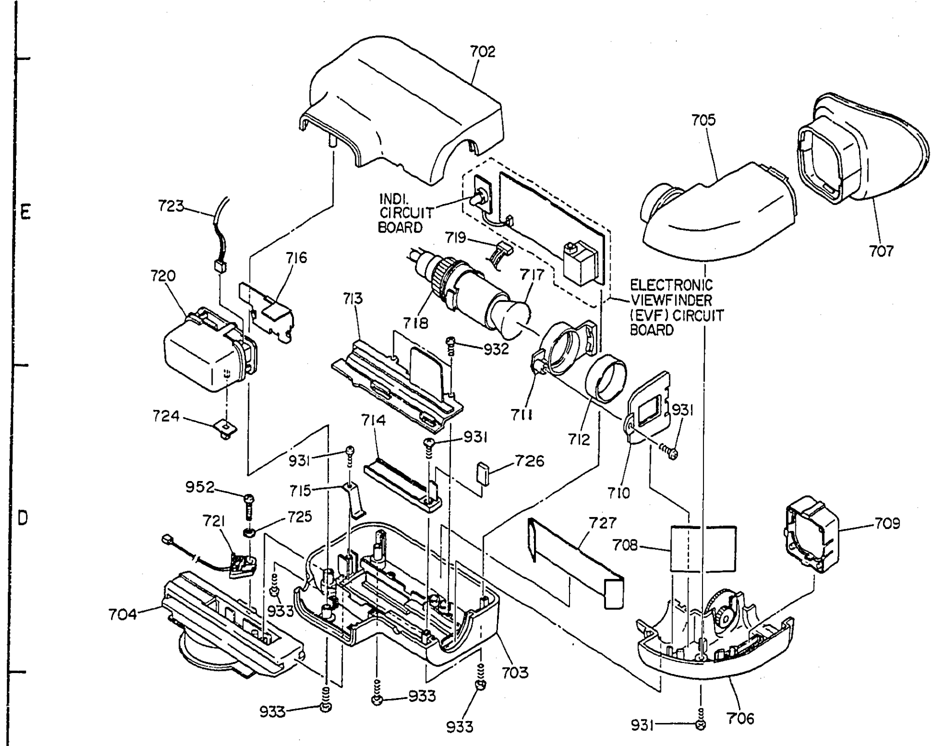
Ⓢ Sonic slider oil (#1600)

Ⓕ Froil (G31-SAY)

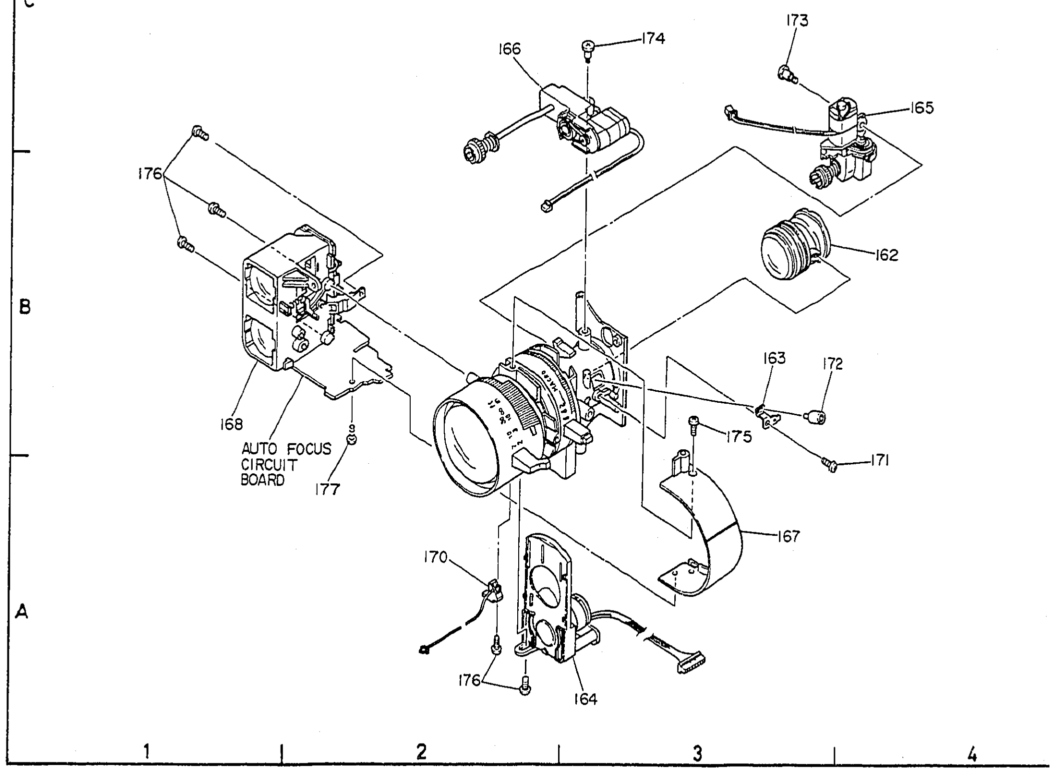
CHASSIS (LOWER) SECTION


E
D
C
B
A
1
2
3
4
217
964
306
307
312
286
953
216
308
961
952
301
309
302
305
960
304
303
Ⓕ = FROIL
Ⓢ = OIL
Ⓕ
Ⓢ

ELECTRONIC VIEWFINDER(EVF) SECTION



LENS SECTION



CHAPTER 7 REPLACEMENT PARTS LEST

SYMBOL-NO	P-NO	DESCRIPTION
		MECHANISM SECTION
101	4720442	LID, CASSETTE (FOR VM-4400A)
101	4720448	LID, CASSETTE (FOR VM-4450A, VM-4450AW)
102	4713271	LID, GRIP
103	6443864	COVER
105	6816621	CAP, TERMINAL
106	6439568	CAP
107	6812981	LID, BATTEY
109	4713471	CASE(R)
110	6070401	KNOB, BATT
111	6815191	LEVER, LOCK
112	5602251	SWITCH
113	6444011	COVER
114	6443815	COVER, CYLINDER
115	6336501	HANDLE ASSY
116	43426213	PAD
118	4742241	BUTTON ASSY
119	4742461	BUTTON
120	6813501	HOLDER
121	4742471	BUTTON
122	6813511	HOLDER
124	6443851	COVER, FIN
126	6443671	STRAP, HAND
127	4344081	SPACER
132	4713292	CASE(L) (FOR VM-4400A)
132	4713297	CASE(L) (FOR VM-4450A, VM-4450AW)
135	6185752	FRAME, BOTTOM
136	6813391	HOLDER
137	6816761	HOLDER, CBA
143	4720401	PANEL, AV
144	6815551	HOLDER, JACK
145	6812961	HOLDER, BATTERY
146	4712731	TERMINAL
147	6816871	PIECE
149	4343971	SPACER
162	6961362	LENS, REAR
163	6961363	HOLDER
164	6961364	IRIS BLOCK
165	6961365	MOTOR, ZOOM
166	6961366	MOTOR, AUTO FOCUS
167	6961367	COVER
168	1629211	PWB ASSY AUTO FOCUS BLOCK
170	6961378	SWITCH
171	6961371	SCREW (1.7X3)
172	6961372	SCREW
173	6961373	SCREW
174	6961374	SCREW
175	6961375	SCREW (1.7X4)
176	6961376	SCREW (1.7X4)
177	6961377	SCREW (2X3.5)
200	4528342	COLLAR, RING
202	4895801	RING ASSY
203	4390342	WASHER
204	6812841	COLLAR, RING
205	4895315	PLATE
206	4895391	LINK, RING
207	6638741	BASE, GUIDE ROLLER
208	7774941	E-RING
209	6823102	GUIDE
210	4895401	PLATE, GUIDE
211	4582341	PLATE, GUDIE
212	6349221	GEAR
214	6440821	GEAR
215	6440831	GEAR
216	6594402	RUBBER
217	1470041	MOTOR, CAPSTAN
218	6638731	BASE, CYLINDER
219	6424831	ROLLER, IMPEDANCE
220	6815201	STOPPER
221	6524233	SPRING
222	7773781	NUT
223	7789315	WASHER
224	7786211	POLYESTER WASHER
225	4895431	ROLLER
226	4582031	BRACKET
227	6638771	ARM
228	7774942	E RING
229	6812851	PLATE, GUDIE
230	6824041	GUIDE ASSY
232	6812861	PLATE, GUDIE
233	6822861	LEVER
234	6558024	SPRING
235	5443501	HEAD, AUDIO CONTROL
236	4895461	ARM
237	6523252	SPRING
238	6889441	MINI CLAMP
239	7785673	NUT
240	6553043	SPRING
241	6813221	PLATE
242	0173092	DEW SENSOR
243	4134171	GUIDE
244	4580223	ARM, TENTION
246	4895472	ARM
247	4580212	ARM
248	6558074	SPRING
249	6558085	SPRING
251	4390345	WASHER
252	6815581	ARM
253	6558147	SPRING
254	4580235	ARM(FOR VM-4400A)
254	4580234	ARM(FOR VM-4450A, VM-4450AW)
255	4527063	GUIDE
256	6553054	SPRING
257	4390343	WASHER
258	7794886	ROLLER, GUIDE
259	6344745	ROLLER
260	6812461	REEL, SUPPLY
261	6812462	REEL, TAKE-UP
262	7787615	POLY-SLIDER WASHER
263	6813294	ARM
264	6556782	SPRING
265	6813421	HOLDER
266	4897102	HOLDER, LOCK
267	4895691	BRACKET
268	6812481	SLIDER
269	6815222	HOLDER
270	6558043	SPRING
271	6552944	SPRING
272	7789931	WASHER
273	88111133	WASHER 2.6MMD 2REQ'D
274	6815121	CLEANING HEAD
277	6812531	ARM
278	6812541	ARM
279	6813241	HOLDER
280	6813251	BAND, TENTION
281	6524361	SPRING
282	4390349	WASHER
284	7789864	WASHER

SYMBOL-NO	P-NO	DESCRIPTION
285	7774942	E RING
287	6553071	SPRING
288	7778859	WASHER
289	7778393	E RING
290	7787573	WASHER
291	6823022	ARM
292	4582581	ARM OPERATION
293	4582571	SLINDER
294	4390751	WASHER
301	5794081	BRUSH
302	4580921	ARM, CAM
303	6812571	LOADING BLOCK
304	5610881	SWITCH
305	6812601	REEL BOLCK
306	6401422	PULLY
307	6823012	GUIDE
308	6351571	BELT
309	6812691	ARM
312	6815601	ARM
401	4895731	HOLDER ASSY, CASSETTE
501	5436521	CYLINDER, UPPER (CY-C3NA-U)
502	5436531	CYLINDER, LOWER (CY-C3NA-L)
601	6961072	LENS, ZOOM ASSY
602	4896941	PLATE
603	5318392	IC MN3715H(CCD IMAGE DEVICE)
604	6813371	COVER, SENSOR
605	6408031	RUBBER
606	6816261	GUDIE, SENSOR
607	5783251	FILTER
608	7479342	CASE, SHIELD
609	7479352	LID, SHIELD
610	7479361	PLATE, SHIELD
611	6185731	FRAME, LENS
612	4750961	KNOB, IRIS
613	1388781	PWB ASSY TG-MN
701	7057081	EVF ASSY
702	4712751	CASE, UPPER
703	4712771	CASE, BOTTOM
704	6443631	SHOW, EVF
705	4712801	NECK, UPPER
706	4712811	NECK, BOTTOM
707	4712831	PIECE, EYE
708	4895941	MIRROR
709	6962071	LENS, EVF
710	6813001	COVER, CRT
711	6812991	HOLDER, CRT
712	6594361	RUBBER
713	6813011	HOLDER, CORD
714	6813041	GUDIE, CORD
715	6529261	SPRING
716	7479231	CASE, SHIELD
717	5319051	CRT(M01KQM07WB)
718	5242111	DEFLECTION YOKE
719	5887041	MINI CONNECTOR
720	5420872	MICROPHONE
721	5602231	SWITCH
723	5845761	CONNECTOR
724	4751011	KNOB
725	7406901	WASHER
726	6563751	SHEET
727	4343961	SPACER
901	86993083	SCREW (2.6X8) BLACK
902	7773871	SCREW (2.6X4)
903	7784782	SCREW (3X4)
904	8691308	SCREW BT2.6MMDX8MM

SYMBOL-NO	P-NO	DESCRIPTION
907	8639306	SCREW(2.6X6)
908	7775945	SCREW(2X5)
909	8639110	SCREW
910	7784373	SCREW
911	8691108	SCREW(2X8)
912	8650103	SCREW(2X3)
921	7775967	SCREW(2X7)
922	7773841	SCREW (2X4)
923	8691105	SCREW
924	8612112	SCREW (2X12BT)
925	7775882	SCREW(2X4)
926	8639108	SCREW(2X8)
931	8699106	SCREW(2X6)
932	86190023	SCREW (1.7X4)
933	8699112	SCREW (2X12)
951	7782616	SCREW
952	87411063	SCREW (2X6)
953	7773681	SCREW
954	8741406	SCREW(3X6)
956	8741110	BIND SCREW-2MMDX 10MM
957	8741104	SCREW (2X4)
958	7782619	SCREW 2X5
959	6911101	SCREW
960	86911083	SCREW(2X8)
961	87411033	SCREW(2X3B)
962	8741306	SCREW(2.6X6)
963	7773731	SCREW
964	8652114	SCREW (2.0X14)
965	7775882	SCREW(2X4)
968	7784131	SCREW(3X8)
		ACCESSORIES
	7021793	OPERATING GUIDE(FOR VM-4400A)
	7021794	OPERATING GUIDE(FOR VM-4450A)
	7021797	OPERATING GUIDE(FOR VM-4450AW)
	4133061	STRAP, SHOULDER
	4133731	ADAPTOR, AC(FOR VM-4400A)
	4133732	AC ADAPTER(FOR VM-4450A, VM-4450AW)
	4132402	LIGHT, DC(FOR VM-4450A, VM-4450AW)
	5861551	A/V OUT CABLE
	4133751	CASE, SIDE(FOR VM-4450A)
	4134821	REMOTE HAND SET (FOR VM-4450A, VM-4450AW)
	5852571	CORD, DC-DC
	5688282	BOX(FOR VM-4450A, VM-4450AW)
	5857961	COAXIAL RF CABLE (FOR VM-4450A, VM-4450AW)
	7036441	CONVERTER, RF (FOR VM-4450A, VM-4450AW)
	5858201	AUDIO/VIDEO INPUT CABLE
	5662611	SEIMENS PLUG(FOR VM-4450A, VM-4450AW)
		VTR SECTION
C 201	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 203	0893035	CERAMIC CHIP 2200PF+-10% 50V
C 204	0209943	CERAMIC DISC 120PF+-5%
C 205	0209892	CERAMIC CHIP 18PF+-5% 50V
C 206	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 207	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 208	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 209	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 210	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 211	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 213	0893091	CERAMIC CHIP 0.022UF+-10% 16V

SYMBOL-NO	P-NO	DESCRIPTION
C 215	0209904	CERAMIC DISC 560PF+-5% 50V
C 217	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 218	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 219	0209856	CERAMIC DISC 220PF+-5% 50V
C 220	0209905	CERAMIC CHIP 680PF+-5% 50V
C 221	0209896	CERAMIC CHIP 47PF+-5% 50V
C 222	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 223	0209891	CERAMIC CHIP 12PF+-5% 50V
C 224	0893008	CERAMIC CHIP 0.1UF+-10% 16V
C 225	0893008	CERAMIC CHIP 0.1UF+-10% 16V
C 226	0209853	CERAMIC DISC 68PF+-5% 50V
C 227	0209853	CERAMIC DISC 68PF+-5% 50V
C 228	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 229	0893062	CERAMIC CHIP 0.022UF+80-20% 25V
C 234	0209836	CERAMIC CHIP 33PF+-5% 50V
C 235	0209922	CERAMIC DISC 2PF+-5% 50V
C 238	0893063	CERAMIC CHIP 0.022UF+80-20% 25V
C 240	0209895	CERAMIC CHIP 39PF+-5% 50V
C 241	0893008	CERAMIC CHIP 0.1UF+-10% 16V
C 250	0893063	CERAMIC CHIP 0.022UF+80-20% 25V
C 252	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 253	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 254	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 255	0209853	CERAMIC DISC 68PF+-5% 50V
C 256	0893035	CERAMIC CHIP 2200PF+-10% 50V
C 257	0209880	CERAMIC CHIP 10PF+-0.5% 50V
C 258	0209851	CERAMIC DISC 15PF+-5% 50V
C 259	0209851	CERAMIC DISC 15PF+-5% 50V
C 260	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 261	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 262	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 263	0893063	CERAMIC CHIP 0.022UF+80-20% 25V
C 264	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 265	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 266	0893039	CERAMIC CHIP 4700PF+-10% 50V
C 268	0209896	CERAMIC CHIP 47PF+-5% 50V
C 269	0209892	CERAMIC CHIP 18PF+-5% 50V
C 270	0209847	CERAMIC CHIP 82PF+-10% 50V
C 271	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 272	0893008	CERAMIC CHIP 0.1UF+-10% 16V
C 274	0209846	CERAMIC CHIP 33PF+-10% 50V
C 275	0209894	CERAMIC CHIP 27PF+-10% 50V
C 276	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 277	0209854	CERAMIC DISC 330PF+-5% 50V
C 278	0209880	CERAMIC CHIP 10PF+-0.5% 50V
C 279	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 281	0209846	CERAMIC CHIP 33PF+-10% 50V
C 283	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 284	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 285	0209895	CERAMIC CHIP 39PF+-5% 50V
C 286	0209846	CERAMIC CHIP 33PF+-10% 50V
C 287	0209846	CERAMIC CHIP 33PF+-10% 50V
C 288	0893063	CERAMIC CHIP 0.022UF+80-20% 25V
C 290	0893063	CERAMIC CHIP 0.022UF+80-20% 25V
C 293	0893063	CERAMIC CHIP 0.022UF+80-20% 25V
C 295	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 297	0893055	CERAMIC CHIP 0.1UF+80-20% 16V
C 298	0893063	CERAMIC CHIP 0.022UF+80-20% 25V
C 300	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 302	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 303	0209853	CERAMIC DISC 68PF+-5% 50V
C 305	0209948	CERAMIC CHIP 330PF+-5% 50V
C 314	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 317	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 319	0893091	CERAMIC CHIP 0.022UF+-10% 16V

SYMBOL-NO	P-NO	DESCRIPTION
C 320	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 321	0209851	CERAMIC DISC 15PF+-5% 50V
C 324	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 327	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 331	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 332	0893037	CERAMIC CHIP 3300PF+-10% 50V
C 333	0209856	CERAMIC DISC 220PF+-5% 50V
C 418	0204272	POLYESTER FILM 3300PF+-5% 100V
C 420	0209856	CERAMIC DISC 220PF+-5% 50V
C 421	0209906	CERAMIC DISC 820PF+-5% 50V
C 422	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 423	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 424	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 425	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 426	0209856	CERAMIC DISC 220PF+-5% 50V
C 427	0893088	CERAMIC CHIP 0.015UF+-10% 16V
C 429	0893088	CERAMIC CHIP 0.015UF+-10% 16V
C 430	0893039	CERAMIC CHIP 4700PF+-10% 50V
C 432	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 433	0893039	CERAMIC CHIP 4700PF+-10% 50V
C 434	0893039	CERAMIC CHIP 4700PF+-10% 50V
C 436	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 437	0893037	CERAMIC CHIP 3300PF+-10% 50V
C 438	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 439	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 440	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 441	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 442	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 444	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 445	0893059	CERAMIC CHIP 0.47UF+80-20% 16V
C 446	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 506	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 507	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 508	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 509	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 604	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 610	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 617	0893033	CERAMIC CHIP 1500PF+-10% 50V
C 618	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 621	0209856	CERAMIC DISC 220PF+-5% 50V
C 622	0893091	CERAMIC CHIP 0.022UF+-10% 16V
C 624	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 627	0893055	CERAMIC CHIP 0.1UF+80-20% 16V
C 628	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 630	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 804	0201039	CERAMIC CHIP 470PF+-5% 50V (FOR VM-4450A, VM-4450AW)
C 805	0201039	CERAMIC CHIP 470PF+-5% 50V (FOR VM-4450A, VM-4450AW)
C 906	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 907	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 908	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 910	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 912	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 913	0893008	CERAMIC CHIP 0.1UF+-10% 16V
C 914	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 915	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 916	0209893	CERAMIC CHIP 22PF+-10% 50V
C 918	0893055	CERAMIC CHIP 0.1UF+80-20% 16V
C 919	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 920	0209896	CERAMIC CHIP 47PF+-5% 50V
C 921	0209846	CERAMIC CHIP 33PF+-10% 50V
C 922	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 923	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 924	0893014	CERAMIC CHIP 0.01UF+-10% 25V

SYMBOL-NO	P-NO	DESCRIPTION
C 926	0893014	CERAMIC CHIP 0.01UF+-10% 25V
C 927	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 928	0893031	CERAMIC CHIP 1000PF+-10% 50V
C 929	0893055	CERAMIC CHIP 0.1UF+80-20% 16V
C 931	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 932	0893002	CERAMIC CHIP 0.033UF+-10% 16V
C 933	0893055	CERAMIC CHIP 0.1UF+80-20% 16V
C 934	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 935	0893055	CERAMIC CHIP 0.1UF+80-20% 16V
C 936	0893055	CERAMIC CHIP 0.1UF+80-20% 16V
C 937	0893059	CERAMIC CHIP 0.47UF+80-20% 16V
R 201	0104267	CHIP RESISTOR 75 OHM+-5% 1/10W
R 202	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 203	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 207	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 209	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 210	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 211	01038403	CHIP RESISTOR 560 OHM+-5% 0.1W
R 212	01038413	CHIP RESISTOR 680 OHM+-5% 0.1W
R 213	01038343	CHIP RESISTOR 180 OHM+-5% 0.1W
R 214	01038413	CHIP RESISTOR 680 OHM+-5% 0.1W
R 215	01038463	CHIP RESISTOR 1.8KOHM+-5% 0.1W
R 216	01038453	CHIP RESISTOR 1.5KOHM+-5% 0.1W
R 217	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 218	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 219	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 220	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 221	01038353	CHIP RESISTOR 220 OHM+-5% 0.1W
R 222	01038413	CHIP RESISTOR 680 OHM+-5% 0.1W
R 223	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 224	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 225	01038623	CHIP RESISTOR 39KOHM+-5% 0.1W
R 226	01038393	CHIP RESISTOR 470OHM+-5% 0.1W
R 227	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 228	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 229	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 230	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 231	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 232	01038443	CHIP RESISTOR 1.2KOHM+-5% 0.1W
R 233	01038163	CHIP RESISTOR 5.6 OHM+-10% 0.1W
R 234	01038163	CHIP RESISTOR 5.6 OHM+-10% 0.1W
R 235	01038313	CHIP RESISTOR 100 OHM+-5% 0.1W
R 236	01038313	CHIP RESISTOR 100 OHM+-5% 0.1W
R 237	01038623	CHIP RESISTOR 39KOHM+-5% 0.1W
R 238	01038583	CHIP RESISTOR 18KOHM+-5% 0.1W
R 239	01038493	CHIP RESISTOR 3.3KOHM+-5% 0.1W
R 240	01038443	CHIP RESISTOR 1.2KOHM+-5% 0.1W
R 241	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 243	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 244	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 246	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 247	01038403	CHIP RESISTOR 560 OHM+-5% 0.1W
R 250	01038763	CHIP RESISTOR 560KOHM+-5% 0.1W
R 251	01038583	CHIP RESISTOR 18KOHM+-5% 0.1W
R 252	01038623	CHIP RESISTOR 39KOHM+-5% 0.1W
R 253	01038353	CHIP RESISTOR 220 OHM+-5% 0.1W
R 254	01038613	CHIP RESISTOR 33KOHM+-5% 0.1W
R 255	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 256	01038443	CHIP RESISTOR 1.2KOHM+-5% 0.1W
R 257	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 258	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 259	01038373	CHIP RESISTOR 330 OHM+-5% 0.1W
R 260	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 261	01038613	CHIP RESISTOR 33KOHM+-5% 0.1W
R 262	01038413	CHIP RESISTOR 680 OHM+-5% 0.1W
R 263	01038413	CHIP RESISTOR 680 OHM+-5% 0.1W
R 264	01038313	CHIP RESISTOR 100 OHM+-5% 0.1W
R 265	01038783	CHIP RESISTOR 820KOHM+-5% 0.1W
R 266	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 267	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 268	01038753	CHIP RESISTOR 470KOHM+-5% 0.1W
R 269	01038623	CHIP RESISTOR 39KOHM+-5% 0.1W
R 270	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 271	01038453	CHIP RESISTOR 1.5KOHM+-5% 0.1W
R 272	01038483	CHIP RESISTOR 2.7KOHM+-5% 0.1W
R 273	01038343	CHIP RESISTOR 180 OHM+-5% 0.1W
R 274	01038373	CHIP RESISTOR 330 OHM+-5% 0.1W
R 275	01038423	CHIP RESISTOR 820 OHM+-5% 0.1W
R 276	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 277	01038653	CHIP RESISTOR 68KOHM+-5% 0.1W
R 278	01038623	CHIP RESISTOR 39KOHM+-5% 0.1W
R 280	01038733	CHIP RESISTOR 330KOHM+-5% 0.1W
R 281	01038453	CHIP RESISTOR 1.5KOHM+-5% 0.1W
R 282	01038393	CHIP RESISTOR 470 OHM+-5% 0.1W
R 285	0103843	CHIP RESISTOR 1KOHM+-5% 0.1W
R 286	01038613	CHIP RESISTOR 33KOHM+-5% 0.1W
R 287	01038933	CHIP RESISTOR 75 OHM+-5% 1/8W
R 288	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 290	01038613	CHIP RESISTOR 33KOHM+-5% 0.1W
R 291	0103843	CHIP RESISTOR 1KOHM+-5% 0.1W
R 292	0103843	CHIP RESISTOR 1KOHM+-5% 0.1W
R 293	0103843	CHIP RESISTOR 1KOHM+-5% 0.1W
R 295	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 296	01038423	CHIP RESISTOR 820 OHM+-5% 0.1W
R 297	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 298	01038643	CHIP RESISTOR 56KOHM+-5% 0.1W
R 299	01038783	CHIP RESISTOR 820KOHM+-5% 0.1W
R 300	01038663	CHIP RESISTOR 82KOHM+-5% 0.1W
R 302	01038403	CHIP RESISTOR 560 OHM+-5% 0.1W
R 308	01038423	CHIP RESISTOR 820 OHM+-5% 0.1W
R 309	01038353	CHIP RESISTOR 220 OHM+-5% 0.1W
R 313	01038723	CHIP RESISTOR 270KOHM+-5% 0.1W
R 314	01038393	CHIP RESISTOR 470 OHM+-5% 0.1W
R 315	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 316	01038393	CHIP RESISTOR 470 OHM+-5% 0.1W
R 317	01038653	CHIP RESISTOR 68KOHM+-5% 0.1W
R 318	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 321	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 327	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 329	01038393	CHIP RESISTOR 470 OHM+-5% 0.1W
R 334	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 335	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 402	01038193	CHIP RESISTOR 10 OHM+-5% 0.1W
R 403	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 404	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 405	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 407	01038583	CHIP RESISTOR 18KOHM+-5% 0.1W
R 408	01038483	CHIP RESISTOR 2.7KOHM+-5% 0.1W
R 409	01038743	CHIP RESISTOR 390KOHM+-5% 0.1W
R 410	01038743	CHIP RESISTOR 390KOHM+-5% 0.1W
R 411	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 412	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 413	01038313	CHIP RESISTOR 100 OHM+-5% 0.1W
R 414	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 415	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 416	01038603	CHIP RESISTOR 27KOHM+-5% 0.1W
R 417	01038713	CHIP RESISTOR 220KOHM+-5% 0.1W
R 418	01038403	CHIP RESISTOR 560 OHM+-5% 0.1W
R 419	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 420	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 421	01038523	CHIP RESISTOR 5.6KOHM+-5% 0.1W
R 422	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 423	0103853	CHIP RESISTOR 6.8KOHM+-5% 0.1W
R 424	01038713	CHIP RESISTOR 220KOHM+-5% 0.1W
R 425	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 426	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 427	01038563	CHIP RESISTOR 12KOHM+-5% 0.1W
R 428	01038343	CHIP RESISTOR 180 OHM+-5% 0.1W
R 429	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 430	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 431	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 432	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 433	01038543	CHIP RESISTOR 8.2KOHM+-5% 0.1W
R 434	01038503	CHIP RESISTOR 3.9KOHM+-5% 0.1W
R 435	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 436	01038403	CHIP RESISTOR 560 OHM+-5% 0.1W
R 439	01038753	CHIP RESISTOR 470KOHM+-5% 0.1W
R 442	01038613	CHIP RESISTOR 33KOHM+-5% 0.1W
R 443	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 445	01038273	CHIP RESISTOR 47 OHM+-5% 0.1W
R 446	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 448	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 449	0103853	CHIP RESISTOR 6.8KOHM+-5% 0.1W
R 450	01038463	CHIP RESISTOR 1.8KOHM+-5% 0.1W
R 452	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 453	01038553	CHIP RESISTOR 100HM+-5% 0.1W
R 454	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 455	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 457	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 501	01038583	CHIP RESISTOR 18KOHM+-5% 0.1W
R 502	01038583	CHIP RESISTOR 18KOHM+-5% 0.1W
R 503	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 504	01038713	CHIP RESISTOR 220KOHM+-5% 0.1W
R 505	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 506	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 507	01038563	CHIP RESISTOR 12KOHM+-5% 0.1W
R 508	01038523	CHIP RESISTOR 5.6KOHM+-5% 0.1W
R 509	01038643	CHIP RESISTOR 56KOHM+-5% 0.1W
R 510	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 511	01038583	CHIP RESISTOR 18KOHM+-5% 0.1W
R 512	01038713	CHIP RESISTOR 220KOHM+-5% 0.1W
R 601	01038193	CHIP RESISTOR 10 OHM+-5% 0.1W
R 602	01038193	CHIP RESISTOR 10 OHM+-5% 0.1W
R 603	01038193	CHIP RESISTOR 10 OHM+-5% 0.1W
R 604	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 605	0104711	CHIP RESISTOR 1 OHM+-5% 1/4W
R 606	0104711	CHIP RESISTOR 1 OHM+-5% 1/4W
R 607	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 608	01038523	CHIP RESISTOR 5.6KOHM+-5% 0.1W
R 609	01038323	CHIP RESISTOR 120OHM+-5% 0.1W
R 610	01038383	CHIP RESISTOR 390 OHM+-5% 0.1W
R 611	01038423	CHIP RESISTOR 820 OHM+-5% 0.1W
R 613	01038733	CHIP RESISTOR 330KOHM+-5% 0.1W
R 614	01038423	CHIP RESISTOR 820 OHM+-5% 0.1W
R 615	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 616	01038573	CHIP RESISTOR 15KOHM+-5% 0.1W
R 617	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 618	01038723	CHIP RESISTOR 270KOHM+-5% 0.1W
R 619	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 620	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 621	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 622	01038643	CHIP RESISTOR 56KOHM+-5% 0.1W
R 623	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 624	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 625	01038543	CHIP RESISTOR 8.2KOHM+-5% 0.1W
R 626	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 628	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 629	01038693	CHIP RESISTOR 150KOHM+-5% 0.1W
R 632	01038383	CHIP RESISTOR 390 OHM+-5% 0.1W
R 633	01038383	CHIP RESISTOR 390 OHM+-5% 0.1W
R 634	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 635	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 636	01038773	CHIP RESISTOR 680KOHM+-5% 0.1W
R 637	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 638	01038623	CHIP RESISTOR 39KOHM+-5% 0.1W
R 639	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 640	01038603	CHIP RESISTOR 27KOHM+-5% 0.1W
R 641	01038523	CHIP RESISTOR 5.6KOHM+-5% 0.1W
R 801	01038193	CHIP RESISTOR 10 OHM+-5% 0.1W (FOR VM-4450A, VM-4450AW)
R 802	0103868	CHIP RESISTOR 120KOHM+-5% 0.1W (FOR VM-4450A, VM-4450AW)
R 803	01038663	CHIP RESISTOR 82KOHM+-5% 0.1W (FOR VM-4450A, VM-4450AW)
R 804	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W (FOR VM-4450A, VM-4450AW)
R 881	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 882	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 883	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 884	01038523	CHIP RESISTOR 5.6KOHM+-5% 0.1W
R 885	01038353	CHIP RESISTOR 220 OHM+-5% 0.1W
R 886	01038503	CHIP RESISTOR 3.9KOHM+-5% 0.1W
R 887	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 888	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 889	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 890	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 891	01038353	CHIP RESISTOR 220 OHM+-5% 0.1W
R 895	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 896	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 897	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 898	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 901	0104262	CHIP RESISTOR 6.8KOHM+-1% 0.1W
R 902	0104111	METAL FILM 10KOHM+-10% 1/10W
R 903	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 904	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 905	01038753	CHIP RESISTOR 470KOHM+-5% 0.1W
R 906	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 907	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 908	01038233	CHIP RESISTOR 22OHM+-5% 0.1W
R 909	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 910	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 911	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 912	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 913	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 914	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 915	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 916	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 917	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 919	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 921	01038763	CHIP RESISTOR 560KOHM+-5% 0.1W
R 922	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 923	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 924	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 925	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 926	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 927	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 928	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 929	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 930	01038693	CHIP RESISTOR 150KOHM+-5% 0.1W
R 931	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W

SYMBOL-NO	P-NO	DESCRIPTION
R 932	0104111	METAL FILM 10KOHM+-10% 1/10W
R 933	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 934	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 935	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W (FOR VM-4400A)
R 936	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 937	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 940	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 941	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 944	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 946	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 947	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 948	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 949	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 950	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 951	01038493	CHIP RESISTOR 3.3KOHM+-5% 0.1W
R 952	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 953	01038593	CHIP RESISTOR 22KOHM+-5% 0.1W
R 954	0104111	METAL FILM 10KOHM+-10% 1/10W
R 955	0103853	CHIP RESISTOR 6.8KOHM+-5% 0.1W
R 956	01038463	CHIP RESISTOR 1.8KOHM+-5% 0.1W
R 957	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 958	01038383	CHIP RESISTOR 390 OHM+-5% 0.1W
R 959	01038493	CHIP RESISTOR 3.3KOHM+-5% 0.1W
R 960	01038503	CHIP RESISTOR 3.9KOHM+-5% 0.1W
R 961	01038403	CHIP RESISTOR 560 OHM+-5% 0.1W
R 962	01038523	CHIP RESISTOR 5.6KOHM+-5% 0.1W
R 963	01038423	CHIP RESISTOR 820 OHM+-5% 0.1W
R 964	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 965	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 969	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 970	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 971	01038493	CHIP RESISTOR 3.3KOHM+-5% 0.1W
R 972	0103833	CHIP RESISTOR 150OHM+-5% 0.1W
R 973	0104111	METAL FILM 10KOHM+-10% 1/10W
R 974	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R 975	01038493	CHIP RESISTOR 3.3KOHM+-5% 0.1W
R 976	01038383	CHIP RESISTOR 390 OHM+-5% 0.1W
R 977	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 978	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 979	01038443	CHIP RESISTOR 1.2KOHM+-5% 0.1W
R 980	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 981	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 982	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 983	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 984	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 985	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 986	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 987	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 992	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 993	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 994	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 995	01038553	CHIP RESISTOR 10KOHM+-5% 0.1W
R 996	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 998	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
RT 201	5040123	SEMI VARIABLE 1KOHM
RT 202	5040124	SEMI VARIABLE 2.2KOHM
RT 203	5040124	SEMI VARIABLE 2.2KOHM
RT 401	5040128	SEMI VARIABLE 47KOHM
RT 601	5040131	SEMI VARIABLE 220KOHM
RV 701	5002016	VARIABLE 10KOHM
D 001	5380933	LED GL-451
D 201	5328321	DIODE MA151K (MH)
D 202	5328321	DIODE MA151K (MH)
D 203	5328303	DIODE MA152WK (MU)

SYMBOL-NO	P-NO	DESCRIPTION
D 204	5328321	DIODE MA151K (MH)
D 205	5328302	DIODE MA152WA(MO)
D 206	5328321	DIODE MA151K (MH)
D 401	5328321	DIODE MA151K (MH)
D 402	5328321	DIODE MA151K (MH)
D 403	5328303	DIODE MA152WK (MU)
D 404	5328321	DIODE MA151K (MH)
D 405	5328321	DIODE MA152WA(MO)
D 501	5328304	DIODE MA152WA (MO)
D 502	5328304	DIODE MA152WA (MO)
D 602	5328321	DIODE MA151K (MH)
D 603	5328321	DIODE MA151K (MH)
D 604	5328321	DIODE MA151K (MH)
D 605	5328321	DIODE MA151K (MH)
D 606	5328321	DIODE MA151K (MH)
D 801	1331111	PHOTOB DIODE PD410PI (FOR VM-4450A, VM-4450AW)
D 901	5337391	DIODE D1FS4
D 902	5328321	DIODE MA151K (MH)
D 903	5328321	DIODE MA151K (MH)
D 904	5328304	DIODE MA152WA (MO)
D 905	5328304	DIODE MA152WA (MO)
D 906	5328303	DIODE MA152WK (MU)
D 907	5328321	DIODE MA151K (MH)
D 908	5337391	DIODE D1FS4
D 909	5328321	DIODE MA151K (MH)
D 913	5328321	DIODE MA151K (MH)
D 914	5328321	DIODE MA151K (MH)
IC 003	1388781	PWB ASSY TG-MN
IC 201	1373213	IC HT7254B
IC 202	1352311	IC HA118041
IC 203	1350801	IC MM1002
IC 204	1352331	IC CXL5507M
IC 205	1352321	IC NJM2262M
IC 401	1350282	IC XRA7757BK
IC 601	1351612	IC HD49741A
IC 602	5307062	IC XRA6454FP
IC 801	1352181	IC IR3T24N(FOR VM-4450A, VM-4450AW)
IC 901	1355346	IC HD404439A23H
IC 902	1352581	IC S8420FF
IC 903	1352024	IC PD6451AGT-803
IC 906	5304282	IC TA7291F
IC 907	1352191	IC XRA10393F
Q 001	1322641	IC NJL5167KB
Q 002	1322641	IC NJL5167KB
Q 004	5324661	TRANSISTOR PT-483F1
Q 201	5328961	TRANSISTOR 2SA1037KERS
Q 203	1323421	TRANSISTOR KSC1623G(0)
Q 204	5328961	TRANSISTOR 2SA1037KERS
Q 205	5326703	TRANSISTOR IMZ1
Q 206	1323421	TRANSISTOR KSC1623G(0)
Q 207	1323421	TRANSISTOR KSC1623G(0)
Q 208	1323421	TRANSISTOR KSC1623G(0)
Q 209	1323421	TRANSISTOR KSC1623G(0)
Q 210	5328796	TRANSISTOR XDC144EK
Q 214	5328796	TRANSISTOR XDC144EK
Q 215	5326101	TRANSISTOR FMW1
Q 216	1323421	TRANSISTOR KSC1623G(0)
Q 217	1323421	TRANSISTOR KSC1623G(0)
Q 218	5328961	TRANSISTOR 2SA1037KERS
Q 219	5328335	TRANSISTOR 2SB709A-RS-T
Q 220	5328796	TRANSISTOR XDC144EK
Q 221	1323421	TRANSISTOR KSC1623G(0)
Q 222	5326206	TRANSISTOR FMC2
Q 223	5328796	TRANSISTOR XDC144EK

SYMBOL-NO	P-NO	DESCRIPTION
Q 225	5326201	TRANSISTOR FMG2
Q 226	5326101	TRANSISTOR FMW1
Q 229	5328961	TRANSISTOR 2SA1037KERS
Q 230	1323421	TRANSISTOR KSC1623G(0)
Q 231	5328721	TRANSISTOR 2SD1328
Q 233	5328961	TRANSISTOR 2SA1037KERS
Q 234	5328796	TRANSISTOR XDC144EK
Q 235	5328796	TRANSISTOR XDC144EK
Q 236	5326201	TRANSISTOR FMG2
Q 401	1323201	TRANSISTOR 2SC2412K (LN)
Q 403	5328961	TRANSISTOR 2SA1037KERS
Q 404	5328796	TRANSISTOR XDC144EK
Q 405	1323421	TRANSISTOR KSC1623G(0)
Q 406	5328351	TRANSISTOR 2SD602R(WR)
Q 407	5326691	TRNSISTOR FMW3
Q 408	5328796	TRANSISTOR XDC144EK
Q 409	5328351	TRANSISTOR 2SD602R(WR)
Q 410	5328797	TRANSISTOR XDA144EK
Q 416	5326201	TRANSISTOR FMG2
Q 417	5326201	TRANSISTOR FMG2
Q 501	5326513	TRANSISTOR 2SB1188 (R)
Q 502	5328961	TRANSISTOR 2SA1037KERS
Q 503	5326206	TRANSISTOR FMC2
Q 504	5326201	TRANSISTOR FMG2
Q 505	5326201	TRANSISTOR FMG2
Q 506	5326693	TRANSISTOR FMY3
Q 507	1323421	TRANSISTOR KSC1623G(0)
Q 508	1323421	TRANSISTOR KSC1623G(0)
Q 901	5328961	TRANSISTOR 2SA1037KERS
Q 902	5328796	TRANSISTOR XDC144EK
Q 903	1323421	TRANSISTOR KSC1623G(0)
Q 908	5328796	TRANSISTOR XDC144EK
Q 909	1323081	TRANSISTOR 2SA1036K
Q 910	5328961	TRANSISTOR 2SA1037KERS
Q 912	5328796	TRANSISTOR XDC144EK
Q 913	1323421	TRANSISTOR KSC1623G(0)
Q 915	1323421	TRANSISTOR KSC1623G(0)
ZD 202	5337011	DIODE MA3075L
ZD 901	5337011	DIODE MA3075L
ZD 903	5337011	DIODE MA3075L
ZD 905	5337011	DIODE MA3075L
ZD 906	5337011	DIODE MA3075L
T 401	5261382	COIL
T 402	5261381	COIL
L 201	0773124	CHOKE COIL 27UH+-5%
L 202	0773004	COIL 100UH
L 205	0773004	COIL 100UH
L 206	0773127	CHOKE COIL 47UH+-5%
L 207	0773136	CHOKE COIL 220UH+-5%
L 208	5159099	CHOKE COIL 820UH
L 209	0773124	CHOKE COIL 27UH+-5%
L 211	0773118	CHOKE COIL 10UH+-5%
L 214	0773127	CHOKE COIL 47UH+-5%
L 221	0773004	COIL 100UH
L 222	0773004	COIL 100UH
L 223	0773129	CHOKE COIL 68UH+-5%
L 224	0773132	CHOKE COIL 100UH+-5%
L 225	0773004	COIL 100UH
L 226	0773126	CHOKE COIL 39UH+-5%
L 227	0773118	CHOKE COIL 10UH+-5%
L 228	0773128	COIL
L 229	0773136	CHOKE COIL 220UH+-5%
L 230	0773118	CHOKE COIL 10UH+-5%
L 231	0773127	CHOKE COIL 47UH+-5%
L 232	0773123	CHOKE COIL 22UH+-5%

SYMBOL-NO	P-NO	DESCRIPTION
L 233	0773121	CHOKE COIL 15UH+-5%
L 234	0773004	COIL 100UH
L 235	0773004	COIL 100UH
L 236	0773004	COIL 100UH
L 238	0773004	COIL 100UH
L 401	5152723	CHOKE COIL 22MH+-5%
L 402	5159111	CHOKE COIL 5600UH
L 403	0773006	COIL 330UH
L 404	0773006	COIL 330UH
L 405	0773005	COIL 220UH
L 507	0773002	COIL 22UH
L 508	0773002	COIL 22UH
L 509	0773001	CHOCE COIL 10UH+-10%
L 901	0773004	COIL 100UH
X 201	5781901	CRYSTAL
BL 501	4133663	PWB ASSY SWR CONTORL
CP 201	5172211	LC FILTER
CP 202	5172222	FILTER
CP 204	5172454	FILTER, LOW PASS
CP 205	5172503	FILTER, TRAP
CP 206	5172351	FILTER
CP 901	5172132	FILTER, LC
CX 901	5784531	OSCILLATOR
CX 902	5778231	CRYSTAL
DL 201	5785887	DELAY LINE BLOCK
F 901	5721952	FUSE 2A
F 902	5721952	FUSE 2A
JK 201	5694721	SOCKET
JK 401	5673911	JACK
JK 901	5693501	JACK, DC
JK 902	5694811	MINI JACK
LED 901	5382211	DIODE LN1251CAL-23
S 001	5635511	SWITCH
S 002	5602161	SWITCH
S 401	5621941	SWITCH
S 902	5634861	SWITCH
S 903	5621701	SWITCH
S 904	5634861	SWITCH
S 905	5634861	SWITCH
S 906	5634861	SWITCH
S 907	5634861	SWITCH
S 908	5634861	SWITCH
S 910	5634861	SWITCH
S 911	5634861	SWITCH
S 912	5634861	SWITCH
S 913	5634861	SWITCH
SW 701	5634884	SWITCH
SW 704	5634933	SWITCH
SW 705	5635471	SWITCH
SW 706	5634884	SWITCH
SW 707	5634884	SWITCH
SW 708	5634884	SWITCH
SW 709	5634884	SWITCH
SW 711	5634884	SWITCH
SW 713	5634884	SWITCH
SW 714	5634933	SWITCH
SW 715	5634884	SWITCH
SW 719	5621474	SWITCH
SW 725	5634884	SWITCH
		CAMERA SECTION
C 001	0893065	CERAMIC CHIP 0.047UF+80-20% 25V
C 002	0893065	CERAMIC CHIP 0.047UF+80-20% 25V
C 003	0893065	CERAMIC CHIP 0.047UF+80-20% 25V

SYMBOL-NO	P-NO	DESCRIPTION
C 004	0893065	CERAMIC CHIP 0. 047UF+80-20% 25
C 005	0893223	CERAMIC CHIP 0. 047UF+80-20% 16V
C 006	0893223	CERAMIC CHIP 0. 047UF+80-20% 16V
C 007	0893121	CERAMIC CHIP 39PF+-5% 50V
C 009	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 011	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 012	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 013	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 014	0893239	CERAMIC CHIP 0. 01UF+80-20% 50V
C 015	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 016	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 019	0893067	CERAMIC CHIP 0. 1UF+80-20% 25V
C 020	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 021	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 023	0893059	CERAMIC CHIP 0. 47UF+80-20% 16V
C 024	0893239	CERAMIC CHIP 0. 01UF+80-20% 50V
C 025	0893117	CERAMIC CHIP 22PF+-5% 50V
C 026	0893124	CHIP CERAMIC 68PF+-5% 50V
C 027	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 028	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 029	0893225	CERAMIC CHIP 0. 1UF+80-20% 16V
C 030	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 039	0893124	CHIP CERAMIC 68PF+-5% 50V
C 040	0893121	CERAMIC CHIP 39PF+-5% 50V
C 099	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 101	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 102	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 103	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 104	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 105	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 106	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 107	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 108	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 109	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 110	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 111	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 112	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 113	0201022	CERAMIC CHIP 15PF+-5% 50V
C 114	0201022	CERAMIC CHIP 15PF+-5% 50V
C 116	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 117	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 118	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 119	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 120	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 121	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 122	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 123	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 124	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 125	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 126	0893062	CERAMIC CHIP 1UF+80-20% 16V
C 127	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 128	0893063	CERAMIC CHIP 0. 022UF+80-20% 16V
C 129	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 132	0893014	CERAMIC CHIP 0. 01UF+-10% 25V
C 133	0893014	CERAMIC CHIP 0. 01UF+-10% 25V
C 135	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 136	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 137	0893014	CERAMIC CHIP 0. 01UF+-10% 25V
C 138	0893014	CERAMIC CHIP 0. 01UF+-10% 25V
C 139	0893014	CERAMIC CHIP 0. 01UF+-10% 25V
C 140	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 141	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 142	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 143	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 144	0893065	CERAMIC CHIP 0. 047UF+80-20% 25V

SYMBOL-NO	P-NO	DESCRIPTION
C 145	0893063	CERAMIC CHIP 0. 022UF+80-20% 25V
C 146	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 147	0893055	CERAMIC CHIP 0. 1UF+80-20% 16V
C 148	0893014	CERAMIC CHIP 0. 01UF+-10% 25V
C 149	0893014	CERAMIC CHIP 0. 01UF+-10% 25V
C 167	0201026	CERAMIC CHIP 39PF+-5% 50V
C 168	0201026	CERAMIC CHIP 39PF+-5% 50V
C 169	0201027	CERAMIC CHIP 47PF+-5% 50V
C 170	0201021	CERAMIC CHIP 12PF+-5% 50V
CT 101	5058575	TRIMMER
R 001	0790024	CHIP RESISTOR 100 OHM+-5% 1/16W
R 002	0790024	CHIP RESISTOR 100 OHM+-5% 1/16W
R 003	01038313	CHIP RESISTOR 100 OHM+-5% 0. 1W
R 004	0790024	CHIP RESISTOR 100 OHM+-5% 1/16W
R 005	0790045	CHIP RESISTOR 3. 9KOHM+-5% 1/16W
R 006	01038313	CHIP RESISTOR 100 OHM+-5% 0. 1W
R 007	0790046	CHIP RESISTOR 4. 7KOHM+-5% 1/16W
R 009	0790035	CHIP RESISTOR 680 OHM+-5% 1/16W
R 012	0790042	CHIP RESISTOR 2. 2KOHM+-5% 1/16W
R 013	0790045	CHIP RESISTOR 3. 9KOHM+-5% 1/16W
R 015	01038553	CHIP RESISTOR 10KOHM+-5% 0. 1W
R 016	01038553	CHIP RESISTOR 10KOHM+-5% 0. 1W
R 017	01038563	CHIP RESISTOR 12KOHM+-5% 0. 1W
R 018	01038673	CHIP RESISTOR 100KOHM+-5% 0. 1W
R 020	01038633	CHIP RESISTOR 47KOHM+-5% 0. 1W
R 022	0790013	CHIP RESISTOR 15 OHM+-5% 1/16W
R 059	0790052	CHIP RESISTOR 12KOHM+-5% 1/16W
R 069	0103828	CHIP RESISTOR 56 OHM+-5% 0. 1W
R 077	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 080	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 084	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 085	01038353	CHIP RESISTOR 220 OHM+-5% 0. 1W
R 086	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 087	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 088	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 089	0790064	CHIP RESISTOR 100KOHM+-5% 1/16W
R 090	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 091	0790064	CHIP RESISTOR 100KOHM+-5% 1/16W
R 092	0790042	CHIP RESISTOR 2. 2KOHM+-5% 1/16W
R 093	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 094	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 095	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 096	0790052	CHIP RESISTOR 12KOHM+-5% 1/16W
R 097	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 098	0790029	CHIP RESISTOR 270 OHM+-5% 1/16W
R 100	01038273	CHIP RESISTOR 47 OHM+-5% 0. 1W
R 102	0790055	CHIP RESISTOR 22KOHM+-5% 1/16W
R 103	0790053	CHIP RESISTOR 15KOHM+-5% 1/16W
R 106	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 107	0790042	CHIP RESISTOR 2. 2KOHM+-5% 1/16W
R 108	01038393	CHIP RESISTOR 470 OHM+-5% 0. 1W
R 109	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 110	01038393	CHIP RESISTOR 470 OHM+-5% 0. 1W
R 111	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 112	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 113	01038393	CHIP RESISTOR 470 OHM+-5% 0. 1W
R 114	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 115	0790043	CHIP RESISTOR 2. 7KOHM+-5% 1/16W
R 116	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 117	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 118	0790052	CHIP RESISTOR 12KOHM+-5% 1/16W
R 119	0104594	CHIP RESISTOR 2. 2KOHM+-5% 1/32W
R 120	0790049	CHIP RESISTOR 8. 2KOHM+-5% 1/16W
R 122	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 123	0790051	CHIP RESISTOR 10KOHM+-5% 1/16W

SYMBOL-NO	P-NO	DESCRIPTION
R 124	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 125	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 126	01038793	CHIP RESISTOR 1MOHM+-5% 0. 1W
R 127	0104093	CHIP RESSISTOR 75 OHM+-5% 1/16W
R 128	0790055	CHIP RESISTOR 22KOHM+-5% 1/16W
R 129	0790066	CHIP RESISTOR 150KOHM+-5% 1/16W
R 130	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 131	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 132	0790043	CHIP RESISTOR 2. 7KOHM+-5% 1/16W
R 133	0104502	CHIP RESISTOR 820 OHM+-1% 1/16W
R 134	0104554	CHIP RESISTOR 1KOHM+-1% 1/16W
R 135	0790043	CHIP RESISTOR 2. 7KOHM+-5% 1/16W
R 140	0104542	CHIP RESISTOR 10KOHM+-1% 1/16W
R 141	0104542	CHIP RESISTOR 10KOHM+-1% 1/16W
R 143	0790051	CHIP RESISTOR 10KOHM+-5% 1/16W
R 144	0790052	CHIP RESISTOR 12KOHM+-5% 1/16W
R 145	0790049	CHIP RESISTOR 8. 2KOHM+-5% 1/16W
R 146	01038433	CHIP RESISTOR 1KOHM+-5% 0. 1W
R 147	0790043	CHIP RESISTOR 2. 7KOHM+-5% 1/16W
R 148	0104581	CHIP RESISTOR 1KOHM+-5% 1/32W
R 150	0790049	CHIP RESISTOR 8. 2KOHM+-5% 1/16W
R 151	01038493	CHIP RESISTOR 3. 3KOHM+-5% 0. 1W
R 152	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 153	0790034	CHIP RESISTOR 560 OHM+-5% 1/16W
R 154	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 155	01038413	CHIP RESISTOR 680 OHM+-5% 0. 1W
R 156	01038793	CHIP RESISTOR 1MOHM+-5% 0. 1W
R 157	01038653	CHIP RESISTOR 68KOHM+-5% 0. 1W
R 158	0103853	CHIP RESISTOR 6. 8KOHM+-5% 0. 1W
R 159	0790044	CHIP RESISTOR 3. 3KOHM+-5% 1/16W
R 160	01038653	CHIP RESISTOR 68KOHM+-5% 0. 1W
R 162	0790051	CHIP RESISTOR 10KOHM+-5% 1/16W
R 166	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 167	0790028	CHIP RESISTOR 220 OHM+-5% 1/16W
R 168	0790064	CHIP RESISTOR 100KOHM+-5% 1/16W
R 169	0790055	CHIP RESISTOR 22KOHM+-5% 1/16W
R 170	0790061	CHIP RESISTOR 56KOHM+-5% 1/16W
R 171	0790061	CHIP RESISTOR 56KOHM+-5% 1/16W
R 172	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 176	0790034	CHIP RESISTOR 560 OHM+-5% 1/16W
R 178	0790024	CHIP RESISTOR 100 OHM+-5% 1/16W
R 180	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 181	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 182	0790058	CHIP RESISTOR 39KOHM+-5% 1/16W
R 183	0790058	CHIP RESISTOR 39KOHM+-5% 1/16W
R 184	0790053	CHIP RESISTOR 15KOHM+-5% 1/16W
R 185	01038593	CHIP RESISTOR 22KOHM+-5% 0. 1W
R 186	01038373	CHIP RESISTOR 330 OHM+-5% 0. 1W
R 187	01038413	CHIP RESISTOR 680 OHM+-5% 0. 1W
R 188	0790037	CHIP RESISTOR 1KOHM+-5% 1/16W
R 189	01038423	CHIP RESISTOR 820 OHM+-5% 0. 1W
R 190	0790053	CHIP RESISTOR 15KOHM+-5% 1/16W
R 191	0790069	CHIP RESISTOR 270KOHM+-5% 1/16W
R 192	0790043	CHIP RESISTOR 2. 7KOHM+-5% 1/16W
R 193	0790069	CHIP RESISTOR 270KOHM+-5% 1/16W
R 194	01038483	CHIP RESISTOR 2. 7KOHM+-5% 0. 1W
D 001	5328668	DIODE MA3062L
D 003	5337351	DIODE MA132WK
D 004	5337352	DIODE MA132WA
D 005	5337353	DIODE MA132K
D 102	5337451	DIODE RB715F
D 103	5337017	DIODE MA3051M
D 104	5337361	DIODE SB0505CP
D 105	5330131	DIODE 1S2076
IC 001	5318392	IC MN3715H(CCD IMAGE DEVICE)

SYMBOL-NO	P-NO	DESCRIPTION
IC 002	1352711	IC HA118144
IC 101	1354721	IC HD49306
IC 102	1352671	IC HD49307
IC 103	1354701	IC HG51A002
IC 104	1355701	IC HD6433308RA40F
IC 105	1352651	IC NJM3403AV
IC 107	1354511	IC XRM93C46AF-EA
IC 108	5274431	CONVERTER, DC-DC
IC 109	1350471	IC S-8054ALR
IC 110	1354691	IC HG51A004
Q 001	1323291	TRANSISTOR 2SC4617
Q 002	1323291	TRANSISTOR 2SC4617
Q 003	1323291	TRANSISTOR 2SC4617
Q 006	1323341	TRANSISTOR 2SC4691
Q 007	1323331	TRANSISTOR 2SA1806
Q 008	1323341	TRANSISTOR 2SC4691
Q 009	1323331	TRANSISTOR 2SA1806
Q 101	5328192	TRANSISTOR 2SC2462LD
Q 102	5328192	TRANSISTOR 2SC2462LD
Q 103	1323271	TRANSISTOR DTC144EE
Q 104	5328192	TRANSISTOR 2SC2462LD
Q 105	5326101	TRANSISTOR FMW1
Q 106	5328201	TRANSISTOR 2SC2618(RC)
Q 107	5328201	TRANSISTOR 2SC2618(RC)
Q 108	5328201	TRANSISTOR 2SC2618(RC)
Q 109	5328201	TRANSISTOR 2SC2618(RC)
Q 110	5328341	TRANSISTOR 2SD601Y (RS)
Q 111	5326682	TRANSISTOR XN1B301
Q 112	1323271	TRANSISTOR DTC144EE
L 001	0773094	CHOKE COIL 100UH+-10%
L 002	0773005	COIL 220UH
L 003	0773005	COIL 220UH
L 004	0773005	COIL 220UH
L 101	0773118	CHOKE COIL 10UH+-5%
L 104	0773004	COIL 100UH
L 105	0773093	CHOKE COIL, CHIP 68UH+-20%
L 106	0773004	COIL 100UH
L 107	0773094	CHOKE COIL 100UH+-10%
L 108	0773118	CHOKE COIL 10UH+-5%
L 109	5129114	CHOKE COIL
L 110	0773118	CHOKE COIL 10UH+-5%
L 112	5159246	CHOKE COIL 10UH+-10%
X 101	5778751	CRYSTAL
X 102	5778841	CRYSTAL
BL 001	5172545	LC FILTER
CP 101	5172644	FILTER, BAND PASS
CP 102	5172573	FILTER, LOW PASS
		ELECTRONIC VIEWFINDER SECTION
C 803	0256155	ELECTROLYTIC 10UF 16V
C 805	0256871	ELECTROLYTIC 47UF 25V
C 808	0256153	ELECTROLYTIC 3. 3MF 50V
C 809	0201997	CERAMIC DISC 0. 1UF+80-20% 50V
C 811	0209852	CERAMIC CHIP 180PF+-5% 50V
C 812	0201997	CERAMIC DISC 0. 1UF+80-20% 50V
C 814	0209969	CERAMIC CHIP 0. 1UF+80-20% 25V
C 816	0202151	CERAMIC CHIP 2200PF+-5% 50V
C 817	0209838	CERAMIC CHIP 0. 01UF+-20% 50V
C 818	02561513	ELECTROLYTIC 1UF 50V
R 801	01038523	CHIP RESISTOR 5. 6KOHM+-5% 0. 1W
R 802	01038743	CHIP RESISTOR 390KOHM+-5% 0. 1W
R 803	01038793	CHIP RESISTOR 1MOHM+-5% 0. 1W
R 804	01038793	CHIP RESISTOR 1MOHM+-5% 0. 1W
R 805	01038793	CHIP RESISTOR 1MOHM+-5% 0. 1W

SYMBOL-NO	P-NO	DESCRIPTION
R 806	01038193	CHIP RESISTOR 10 OHM+-5% 0.1W
R 807	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 808	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W
R 809	01038473	CHIP RESISTOR 2.2KOHM+-5% 0.1W
R 811	01038453	CHIP RESISTOR 1.5KOHM+-5% 0.1W
R 812	01038573	CHIP RESISTOR 15KOHM+-5% 0.1W
R 813	01038453	CHIP RESISTOR 1.5KOHM+-5% 0.1W
R 814	01038463	CHIP RESISTOR 1.8KOHM+-5% 0.1W
R 815	01038623	CHIP RESISTOR 39KOHM+-5% 0.1W
R 816	0103814	CHIP RESISTOR 3.9 OHM+-10% 0.1W
R 817	01038463	CHIP RESISTOR 1.8KOHM+-5% 0.1W
R 818	01038633	CHIP RESISTOR 47KOHM+-5% 0.1W
R 819	01038483	CHIP RESISTOR 2.7KOHM+-5% 0.1W
R 820	01038673	CHIP RESISTOR 100KOHM+-5% 0.1W
R 821	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 822	01038313	CHIP RESISTOR 100 OHM+-5% 0.1W
R 824	01038793	CHIP RESISTOR 1MOHM+-5% 0.1W

SYMBOL-NO	P-NO	DESCRIPTION
R 826	01038763	CHIP RESISTOR 560KOHM+-5% 0.1W
R 827	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
R 828	01038433	CHIP RESISTOR 1KOHM+-5% 0.1W
RT 802	5030193	SEMI VARIABLE 470 OHM
RT 803	5035204	SEMI VARIABLE 2.2MOHM
RT 805	5035204	SEMI VARIABLE 2.2MOHM
D 801	5328321	DIODE MA151K (MH)
D 802	5337321	DIODE MA199
D 803	5380691	LED SLR34UR5
IC 801	1351631	IC HA118121FP
Q 801	5323831	TRANSISTOR 2SD974
Q 802	5326682	TRANSISTOR XN1B301
△T 801	5240564	TRANS, FLYBACK
L 801	5152603	CHOKE COIL 47UH
L 802	5244016	COIL
△CS 801	5887001	MINI CONNECTOR
TF 801	5721352	FUSE

HITACHI

HITACHI SALES CORPORATION. TOKYO JAPAN
Head Office : THE HITACHI ATAGO BLDG. No. 15-12, 2-Chome
Nishi-Shinbashi Minato-Ku, Tokyo 105, Japan
Tel:03-3502-2111

AMERICA

HITACHI HOME ELECTRONICS (AMERICA), INC.

Headquarters, Western Regional Office
401 West Artesia Boulevard, Compton,
California 90220 U.S.A.
Tel:213-537-8383 Fax:213-631-4475

Eastern Regional Office

1290 Wall Street West, Lyndhurst, New
Jersey 07071 U.S.A.
Tel:201-935-8980 Fax:201-935-4869

Mid-Western Regional Office

1400 Morse Ave., Elk Grove Village, Illinois.
60007 U.S.A.
Tel:708-593-1550 Fax:708-593-2436

Southern Regional Office

510 Plaza Drive, College Park, Georgia
30349, U.S.A
Tel:404-763-0360 Fax:404-763-0416

HITACHI SALES CORPORATION OF HAWAII. INC.

3219 Koapaka Street, Honolulu, Hawaii,
96819 U.S.A.
Tel:808-836-3621 Fax:808-833-3449

HITACHI (HSC) CANADA INC.

Montreal Office & Manufacturing Division.
3300 Trans-Canada Highway, pointe Claire,
Quebec, H9R 1B1, Canada
Tel:514-697-9150 Fax:514-697-2209

HITACHI SALES CORPORATION DE PANAMA. S.A

Apartado postal 7657, Panama 5, Panama City,
Rep. of panama
Tel:63-65-00, 63-64-91 Fax:64-8827

HITACHI SALES CENTROAMERICANA. S.A.

Apartado Postal 10272-1000
San Rafael de Escazu, San Jose, Costa Rica
Tel:28-20-11 Fax:28-54-77

HITACHI SALES CORPORATION DE EL SALVADOR. S.A.

Apartado Postal N˚ 818 San Salvadore,
El Salvador 11a, Calle Oriente, N˚ 130
Tel:21-29-22, 22-60-14 Fax:22-8372

COMPANIA ELECTRONICA COLOMBIANA. S.A

Apatado Postal 14933
Calle 5a, N˚ 19-A-31, Bogota D.E.
Tel:47-91-16, 47-17-83 Fax:201-8710

MAYORCA – HITACHI. C.A.

Apartado Postal 61189 Caracas-Venczucla 3ra.
Transversal, entrc 1ra. Av. y Av.
Andros Bello Centro Comercial Cayorma.
Piso 3 Los Palos Grandes
Tel:284-90-67, 284-03-11 Fax:283-32-24

ELJURI HITACHI. S.A.

P.O. Box 738 Ave. Huayna Capac 8-57
Cucnca-Ecuador
Tel:831-188, 831-385 Fax:830-797

EUROPE

HITACHI SALES EUROPA GmbH

Rungedamm 2, 2050 Hamburg 80, Germany
Tel:040-734110 Fax:040-7340134

HITACHI SALES (U.K.) Ltd.

Hitachi House, Station Road, Hayes,
Middlesex UB3 4DR, England
Tel:081-848-8787 Fax:081-561-4565

HITACHI FRANCE (RADIO-T.V. ELECTRO-MENAGER) S.A.

95-101 Rue Charles-Michels,
93200 Saint-Denis, France
Tel:1-48-21-6015 Fax:1-42-43-6697

HITACHI SALES SCANDINAVIA AB

Domnarvsgatan 29 Lunda, Box 62,
S-163 91 Spanga, Sweden
Tel:08-7955600 Fax:08-7616250

HITACHI SALES NORWAY A/S

Postboks 68, Bruket 31, N-1620
Gressvik, Norge
Tel:09-328255 Fax:09-329340

SUOMEN HITACHI OY

Takojankatu 5, SF-15800 Lahti 80, Finland
Tel:918-527800 Fax:918-515273

HITACHI SALES A/S

Kuldyssen 13, DK-2630, Taastrup, Denmark
Tel:42-999200 Fax:42-999392

HITACHI SALES A.G.

Bahnhofstrasse, 19, 5600 Lenzburg,
Switzerland
Tel:064-50 22 11 Fax:064-51 60 56

HITACHI SALES WARENHANDELS GmbH

Kreuzgasse 27, A 1180 Wien, Austria
Tel:0222-421678, 0222-421679
Fax:0222-4393675

HITACHI SALES ITALIANA. S.p.A.

Via Ludovico di Breme 9, 20156 Milano, Italy
Tel:02-30231 Fax:2-33400021

HITACHI SALES BELGIUM S.A./ N.V.

Chaussee de Namur 56, B – 1400 Nivelles,
Belgium
Tel:067-21-71-81, 067-21-79-81
Fax:67-21-8078

HITACHI SALES IBERICA. S.A.

Gran Via Carlos Tercero. 101, 1-1,
Barcelona-08028 Spain
Tel:3-330-8652 Fax:3-339-7839

HITACHI SALES (HELLAS) S.A.

91 Falirou Street 11741 Athens, Greece
Tel:9229300 Fax:1-9235566

HITACHI SALES NETHERLAND B.V.

Industrieweg 17-19, 3762 EG Soest,
Postbus 465, 3760 AL Soest, Holland
Tel:02155-16544 Fax:02155-17324

ASIA, AFRICA, OCEANIA

HITACHI SALES (MALAYSIA) SDN. BHD.

Wisma Hitachi, No.2, Loronge 13/6A, 46200
Petaling Jaya, Selangor, Malaysia
Tel:03-7573455 Fax:03-7556090

HITACHI (SINGAPORE) PTE. LTD.

PSA Warehousing Services Alexandra Distripark
Block 1, #01-03, Pasir Panjang Road
Singapore 0511
Tel:2787177 Fax:2734450

HITACHI SALES (THAILAND) LTD.

2240-46, New Petchburi Road, Bankapi,
Hueykuang Bangkok, Thailand
Tel:2-314-2741 Fax:2-319-2460

HITACHI ELECTRIC SERVICE CO.. (HONG KONG) LTD.

3rd Floor Leun Tai Industrial Bldg., 72-76
Kwai Cheong Road Kwai Chung N.T.,
Hong Kong
Tel:420-4101, 424-0126 Fax:480-4493

Hitachi Sales Corporation of Taiwan

Room A, 11F1. No.180, Sec. 4 Chung Hsiao
E. Road, Taipei Taiwan, R. O. C.
Tel:02-721-6686 Fax:02-752-3211

HITACHI PRODUCTIONS MAROC ELECTRONIQUES DOMESTIQUES S.A

Rue du Havre, Casablanca, Morocco
Tel:212-2-30-73-68, 212-2-30-73-57
Fax:212-2-31-67-42

HITACHI CANARIAS S.A.

Calle San-Francisco No. 19, 38002 Santa Cruz
de Tenerife Canary Islands
Tel:9-22-246498 Fax:9-22-242310

HITACHI SALES AUSTRALIA PTY LTD.

153 Keys Road, Moorabbin, Victoria 3189
Australia
Tel:555-8722 Fax:3-532-1815

VM-4400A(U,C)
VM-4450AW,A(PX) **TK** **No.3517E** **TOKAI**

Copyright © Hitachi, Ltd. 1991. All rights reserved.

Printed in Japan (K)

HITACHI
SERVICE MANUAL

TK No. 3518E

VM-4400A

Technical Information

MANUALS RELATED TO THE VM-4400A

MODEL/TITLE	Manual No.
VM-4400A Technical Data	3517E
VM-2300A Technical Information: EVF, Auto focus, Servo, Luminance/chrominance and Audio circuit operations	3283E

CONTENTS

COMPARISONS OF SPECIFICATIONS AND FUNCTIONS················1-1

CAMERA

1. GENERAL
 1-1. Circuit Configulation······························2-1
 1-2. CCD Image Sensor··································2-2
2. CAMERA POWER SUPPLY CIRCUIT···························2-2
3. DATA COMMUNICATION CIRCUT·····························2-2
4. SYNC SIGNAL GENERATOR AND SENSOR DRIVE CIRCUITS
 4-1. Sync Signal generator·····························2-3
 4-2. CCD Sensor Driver·································2-4
5. SIGNAL PROCESSING CIRCUITS
 5-1. CDS/AGC Circuit···································2-5
 5-2. Analog to Digital Converter Circuit···············2-5
 5-3. Digital Signal Processing Circuit·················2-5
 5-4. Digital to Analog Converter Circuit···············2-14
6. MANUAL AND ELECTRONIC ZOOM CONTROL CIRCUITS
 6-1. General···2-15
 6-2. Zoom Motor Control Circuit························2-16
 6-3. Electronic Zoom Control Circuit···················2-16

SYSTEM CONTROL

1. GENFRAL···3-1
2. VCR POWER SUPPLY CIRCUIT
 2-1. General···3-2
 2-2. Power Supply Operation····························3-3
 2-3. Switching Regulator·······························3-3
 2-4. Battery Discharge Level Detection Circuit·········3-3
 2-5. Power Protection Circuit··························3-4
3. DATA COMMUNICATION AND CHARACTER GENERATOR CIRCUIT
 3-1. Data Communication Circuit························3-4
 3-2. Character Generator·······························3-4
4. KEY INPUT/ INDICATOR CIRCUITS
 4-1. Key Input Circuit·································3-5
 4-2. Indicator Control Circuit·························3-5
5. TAPE/TROUBLE SENSOR CIRCUITS
 5-1. Supply and Take-up Reel Sensors···················3-6
 5-2. Suppiy and Take-up End Sensors····················3-6
 5-3. Cylinder Lock Sensor······························3-6
 5-4. Dew Sensor ·······································3-6
 5-5. Cassette State Sensor·····························3-7
 5-6. Safety Tab Sensor·································3-7
6. MECHANISM STATE CONTROL CIRCUIT·······················3-7
7. CAPSTAM MOTOR CONTROL CIRCUIT·························3-7
8. INTERVAL RECORDING OPERATIONS
 8-1. Automatic Interval Recording······················3-8
 8-2. One Shot Recording································3-9
9. EDIT(ASSEMBLE) OPERATIONS·····························3-9
10. PROGRAMMABLE SYNCHRO.EDIT OPERATION··················3-9
11. BLANK SEARCH OPERATION·······························3-10
12. HEAD CLEANING OPERATION······························3-10
13. PIN FUNCTIONS
 13-1. S-μP (IC901)·····································3-10
 13-2. D-μP (IC1104)····································3-12

MECHANISM

1. OVERVIEW··7-1
2. MAJOR COMPONEN LOCATION·······························7-2
3. LOADING BLOCK DRIVER MECHANISM························7-3
4. LOADING DRIVER MECHANISM (1)··························7-4
5. LOADING DRIVER MECHANISM (2)··························7-5
6. PRESSURE ROLLER COMPRESSION MECHANISM·················7-6
7. REEL BLOCK DRIVE MECHANISM····························7-6
8. SL CHASSIS TIMING CHART·······························7-7
9. GUIDE GROOVE TRACE····································7-7

APPENDIX

1. AUDIO SIGNAL PROCESSING BLOCK DIAGRAM·················8-1
2. SIMPLIFED VIDEO CIRCUIT·······························8-1
3. VIDEO INPUT/OUTPUT CIRCUIT BLOCK DIAGRAM··············8-2
4. VIDEO HEAD SWITCHING CIRCUIT BLOCK DIAGRAM············8-2
5. LUMINANCE/CHROMINANCE SIGNAL PROCESSING BLOCK DIAGRAM···8-3

SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

VIDEO CAMERA / RECORDER

Aug. 1991 TOKAI WORKS

Table 1-1 Comparisons of Specifications and Functions

Item		VM-2300A	VM-4400A
GENERAL			
Weight (kg)		2.2	2.1
Dimensions (W×H×D mm)		121×202×368	136×195×392
Power Voltage		DC 9.6V	Same as VM-2300A
Power Consumption		9.6 W (During recording)	7.7 W (During recording)
CAMERA SECTION			
Image Sensor		1/2" CCD	1/3" CCD
Number of Pixels (H×V)		542×494 (267,748)	Same as VM-2300A
Lens	Zoom Ratio	6:1	8:1
	Zoom Speed	1 Speed	Same as VM-2300A
	F. No	1.4	Same as VM-2300A
	Lens Diameter	46mm	Same as VM-2300A
	Focus	IR Automatic/Manual	Same as VM-2300A
	Tele/Wide-Macro	Yes (0.6m)	Same as VM-2300A
	Required Minimum illumination	3 lux	2 lux
	Iris Control	Automatic/Manual	Programmed Automatic/Manual
Programmed AE		No	Yes (1/60, 1/120, 1/250)
Electornic Shutter Speed		Yes (1/60, 1/500, 1/1000)	Yes (1/60, 1/120, 1/250, 1/1000, 1/2000, 1/10000)
White Balance Control		Automatic/Manual	Programmed Automatic/Manual
Fade in/out		Yes	Same as VM-2300A
Neg./Pos. Invertion		Yes	Same as VM-2300A
Built-in Titler		Yes	Same as VM-2300A
Electronic Viewfinder		2/3" B/W	Same as VM-2300A
Display	Operation Mode	Yes	Same as VM-2300A
	Battery Remain	Yes ("-" graph.)	Yes (Batt. graph.)
	Counter/Remain	Yes	Same as VM-2300A
	Shutter Speed	Yes	Same as VM-2300A
	Warning	Yes (DEW, NO TAPE etc.)	Same as VM-2300A
	Date/Time	Yes	Same as VM-2300A
	E. Zoom Ratio	No	Yes (8× - 64×)

Item	VM-2300A	VM-4400A
VCR SECTION		
Cassette Tape	VHS Full size	Same as VM-2300A
VHS HQ System	Yes	Same as VM-2300A
Video Heads on Cylinder	2 (Width: 65μm)	Same as VM-2300A
Flying Erase Head	Yes	Same as VM-2300A
Tape Speed	SP	Same as VM-2300A
Maximum Recording Time	160min.	Same as VM-2300A
Interval Recording	Yes	Same as VM-2300A
One Shot Recording	Yes	Same as VM-2300A
Self Timer Recording	Yes	Same as VM-2300A
INDEX Recording	Yes	Same as VM-2300A
INDEX Search	No	Yes
Automatic Rewind	Yes	Same as VM-2300A
A/V Dubbing	Yes	Same as VM-2300A
A/V OUT Connector	Yes	Same as VM-2300A
Hot Shoe	No	Yes
Blank Search	No	Yes
Auto Head Cleaning	No	Yes
Audio System	Monaural	Same as VM-2300A
Mic. Mixing	Yes	Same as VM-2300A
Wind Cut Switch	Yes	Same as VM-2300A
Eraphone Speaker	No	Same as VM-2300A
Synchro Edit	Yes	Same as VM-2300A

1. GENERAL

1-1. Circuit Configuration (Fig. 2-1)

This employs a DSP (Digital Camera Signal Processing Circuit) for camera signal processing to improve color reproduction and uses a 1-chip IC to save power consumption and save space. By digital signal processing, the iris and white balance controls are performed by artificial intelligence (AI). The camera signal processing circuit consists of six ICs (IC1001, IC1002, IC1003, IC1101, IC1102, IC1103, IC1104 and IC1107) with which process the signal as follows.

(1) CCD Color Image Sensor (IC1001: CCD SENSOR)

This is a 1/3" interline type CCD color image sensor and converts incoming light from the object to a video signal.

(2) CDS/AGC Circuit (IC1002: CDS/AGC)

This processes a continuous signal and attenuates noise generated by the CCD sensor to improve the signal-to-noise ratio. This also controls the gain of the input signal so that the input supplied to the analog-to-digital converter is constant. The gain of the AGC circuit is controlled by the gain control data supplied from a digital camera signal control microprocessor (IC1104: D-μP).

(3) Sensor Driver (IC1003: SENSOR DRIVE)

This drives the CCD sensor and controls the shutter speed. This is also controlled by IC1104.

(4) Analog-to-Digital Converter (IC1101: A/D CONV)

This converts the image sensor output signal to 9-bit digital image sensor output signal and supplies it to the digital camera signal processing circuit (IC1103: DSP).

(5) Digital Camera Signal Processing Circuit (IC1103: DSP)

This IC inputs the 9-bit digital image sensor output signal and separates it into two digital luminance and chrominance signals. The digital luminance signal is output via internal circuits of enhancer, gamma correction and encoder circuits to a D/A converter (IC1102). The digital chrominance signal is output via internal circuits of RGB matrix, white balance control, gamma correction, R-Y/B-Y matrix and encoder circuits to D/A converter (IC1102).
This also generates sync pulses and timing pulses for processing the digital luminance and chrominance signals and driving the image sensor.

(6) Digital-to-Analog converter (IC1102: D/A CONV)

This IC inputs the digital luminance and chrominance signals, converts them into analog luma and chroma signals and supplies them to the luma/chroma circuit in the VCR circuit.

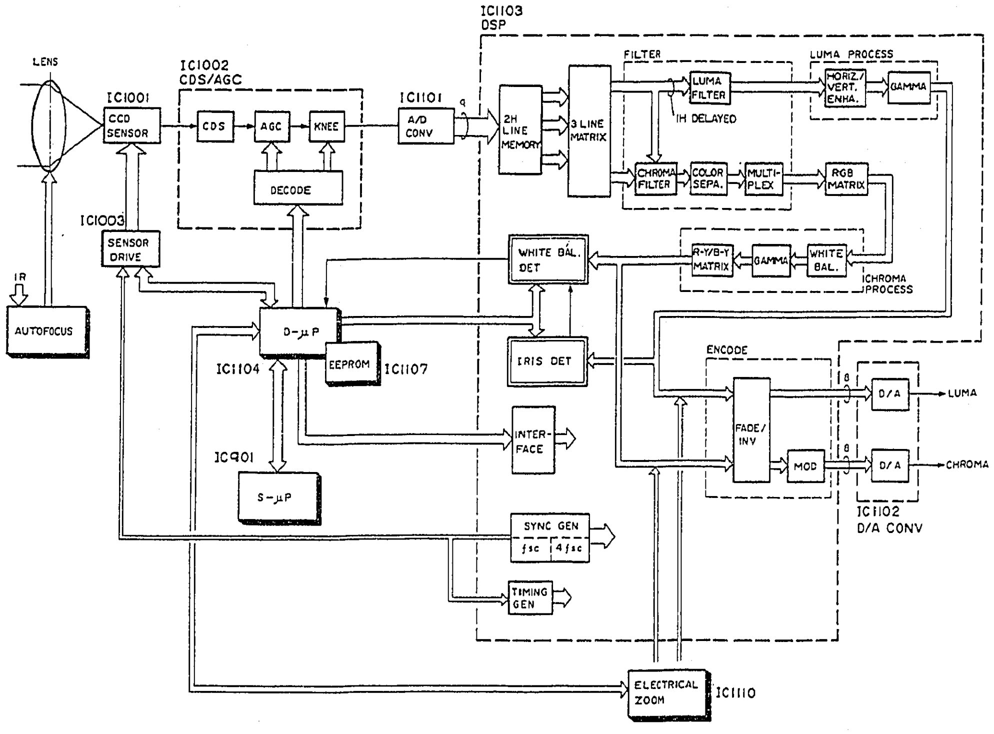

LENS
IC1001
CCD SENSOR
IC1002
CDS/AGC
CDS
AGC
KNEE
DECODE
IC1101
A/D CONV
9
IC1103
DSP
2H LINE MEMORY
3 LINE MATRIX
FILTER
LUMA FILTER
1H DELAYED
CHROMA FILTER
COLOR SEPA.
MULTI-PLEX
LUMA PROCESS
HORIZ./VERT. ENHA.
GAMMA
RGB MATRIX
R-Y/B-Y MATRIX
GAMMA
WHITE BAL.
CHROMA PROCESS
WHITE BAL. DET
IRIS DET
IC1003
SENSOR DRIVE
IR
AUTOFOCUS
D-μP
IC1104
EEPROM
IC1107
IC901
S-μP
INTER-FACE
SYNC GEN
fsc
4fsc
TIMING GEN
ENCODE
FADE/INV
MOD
8
8
D/A
D/A
LUMA
CHROMA
IC1102
D/A CONV
ELECTRICAL ZOOM
IC1110

Fig. 2-1 Circuit Composition of Camera Circuit

(7) Digital Microprocessor (IC1104: D-μP) and EEPROM (IC1107)

IC1104 controls entire camera signal processing circuit and is responsible for five controls, the picture control (horizontal/vertical enhancer, gamma correction, gain control, etc.), auto white balance control, iris control, gain control of the CDS/AGC circuit, shutter speed control.
This IC also detects the operation of the key on the side panel and operation key data is supplied to the system control microprocessor (IC901: S-μP). The picture control data is memorized in an EEPROM (IC1107). If you replace IC1107 or IC1103, you have to input the picture control data to IC1107.

(8) Automatic Focus Control Circuit (AUTOFOCUS)

This controls the focus lens using infrared rays and the circuit composition is the same as that in previous models.

(9) Electronic Zoom (IC1110)

This performs electronic zooming in/out. The maximum zooming ratio is set to 8X in the manual zoom mode, 16X in zoom mode 1and 64X in zoom mode 2.

1-2. CCD Color Image Sensor (Fig. 2-2)

Table 2-1 shows the specifications of the CCD color image sensor.

Table 2-1 Specifications of CCD Sensor

Item	MN3715HFE
Chip Size	6.08mm (H) X 5.00mm (V)
Image Size (Optical)	1/3"
Picture Elements (Total)	542 (H) x 494 (V) (267,748)
Picture Elements (Effective)	512 (H) x 492 (V) (251,904)
Color Filter (Complementary)	Ye, Cy, Mg, G
Readout	Field
Variable Shutter Speed	1/60 (Normal), 1/100 to 1/2000

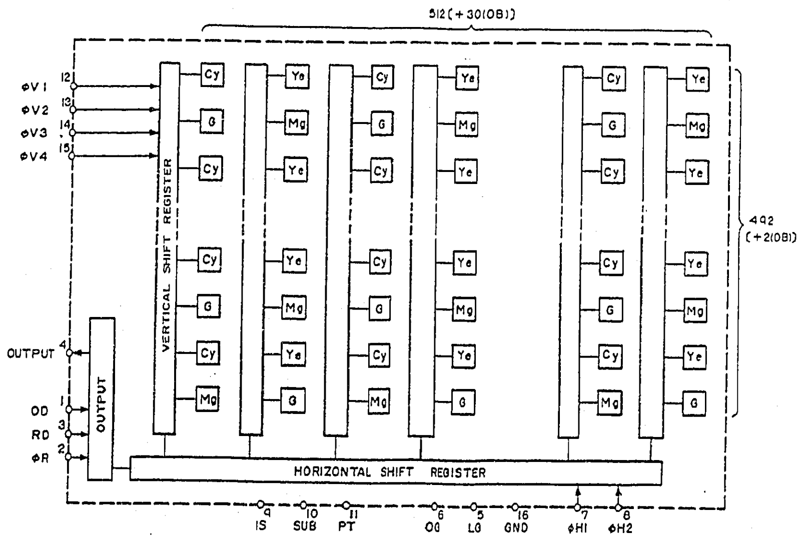

512(+30(OB))
φV1 12
φV2 13
φV3 14
φV4 15
VERTICAL SHIFT REGISTER
Cy
G
Ye
Mg
492 (+2(OB))
OUTPUT 4
OD 1
RD 3
φR 2
OUTPUT
HORIZONTAL SHIFT REGISTER
9 IS
10 SUB
11 PT
6 OG
5 LG
16 GND
7 φH1
8 φH2

Fig. 2-2 Circuit Composition of CCD Image Sensor

2. POWER SUPPLY CIRCUIT (Figs. 2-3)

The power supplies for camera circuit are generated by the DC-to-DC converter (IC1108: DC-DC CONV) whose operation is controlled by a digital camera signal control microprocessor (IC1104: D-μP). IC1104 communicates with a system control microprocessor (IC901: S-μP) via four data communication lines, receives the camera power on data and generates CAMERA ON signal at pin 58. The CAMERA ON signal is supplied to the internal switch (S1) in IC1108 to turn it on. When the switch is turned on, the oscillator starts and generates four power supplies (C5.2V, C9V, C18V and C-8V). C.5.2V is supplied to the camera processing circuit and the other power supplies of C9V, C18V and C-8V are supplied to the image sensor driver circuit.

3. DATA COMMUNICATION CIRCUIT (Figs. 2-3 and 2-4)

The digital processing microprocessor (IC1104) and system control microprocessor (IC901) are connected via four data communication lines (CLOCK(D-S), DATA(D-S), DATA(S-D) and CS(D)). CLOCK(D-S) is a clock pulse and data is transferred/received synchronized with the CLOCK(D-S) pulse. The DATA(D-S) is transferred to IC901 from IC1104 and the DATA(D-S) is transferred to IC1104 from IC901. CS(D) goes "Hi" during data communications.

(1) Communicated Data

IC1104 receives data for state, mode, etc. and transfers data for the on-screen display.

(2) EEPROM (IC1107)

IC1107 is the EEPROM (16-bit x 64-word) and memorizes the function and picture control data for camera signal processing circuit. The function data is system selection data for setting the function (NTSC/PAL/SECAM system, U.S./Europe/Other area, Specification of CCD sensor (270,000 or 410,000 pixels), electronic zoom (with or without and zoom ratio), fade (white or black and luma, chroma or luma/chroma), negative/positive inversion, etc.) and data for setting the characteristics of each circuit (automatic iris control, automatic white balance control), sensitivity of CCD sensor. The picture control data is used for adjustment (iris, Hall, blue matrix, white balance and chroma gain).
IC1107 and IC1104 are connected via four communications lines (CS(ROM), CLOCK(D-ROM), DATA(D-ROM) and DATA(ROM-D)). DATA(D-ROM) is written to IC1107 synchronized with the CLOCK(D-ROM) while CS(ROM) is "Hi".

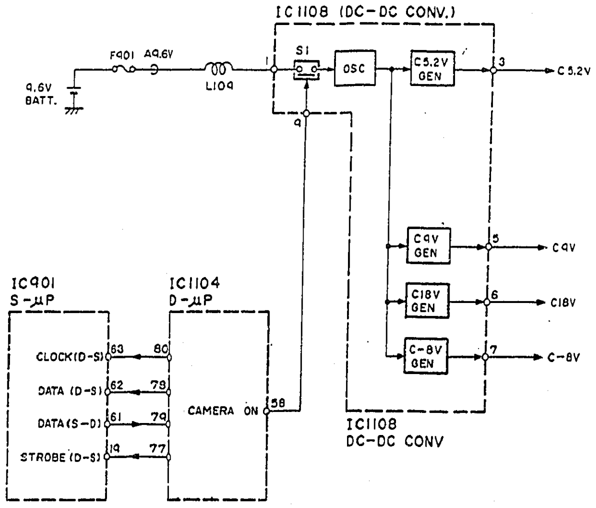


Fig. 2-3 Power Supply Circuit for Camera Block

4. SYNC SIGNAL GENERATOR AND SENSOR DRIVER (Fig. 2-4)

4-1. Sync Signal Generator (IC1103: DSP)

The sync pulses for the sensor driver, D/A converter and internal signal processing circuit are generated by a sync pulse generator (fsc/4fsc SYNC GEN) in the digital camera signal processing circuit (IC1103: DSP). The 4fsc (14.3MHz) clock pulse is used to generate the sync pulse. A crystal oscillator (X1101: 14.3MHz) connected between pins 14 and 13 generates a 14.3MHz clock pulse and this pulse is divided, synchronized with image sensor scanning pulses (REF, fH/2, CLOCK-2 and OB) supplied from the sensor driver (IC1003) to become two clock pulses (CLOCK(D-C), CLOCK(D-Y)) and two sync pulses (C. SYNC, CHD). The sync signals are supplied to the internal camera signal processing circuit, sensor driver (IC1003) and the clock pulses are supplied to D/A converter (IC1102). The frequency of the 14.3MHz clock pulse generator is adjusted by CT1101 connected to pin 13 of IC1103.

4-2. CCD Sensor Driver (IC1003: SENSOR DRIVE)

The CCD sensor driver (IC1003) generates sensor driving pulses (V1 to V4, H1, H2, R and V. SUB), clock pulse for A/D converter (IC1101), timing pulses (REF, fH/2, OB, P.BLK, SP1, SP2 and AE TIMING). These pulses are generated by dividing the 19.07MHz clock pulses supplied from the internal clock oscillator.
The internal crystal oscillator (X1: 19.07MHz) forms a voltage controlled oscillator and generates a 19.07MHz clock pulses. The phase of the clock pulse is compared with that of the CHD and the C.SYNC pulses supplied from IC1103 to synchronize the phase of image sensor driving pulses with that of the sync pulse.

(1) Vertical Shift Register Clock Pulses (ϕV1 to ϕV4)

These are supplied to the vertical shift register and time the transfer of charges from the picture elements to the vertical shift register and their mixing during the vertical blanking period and transfer of charges from the vertical shift register during the horizontal blanking period.

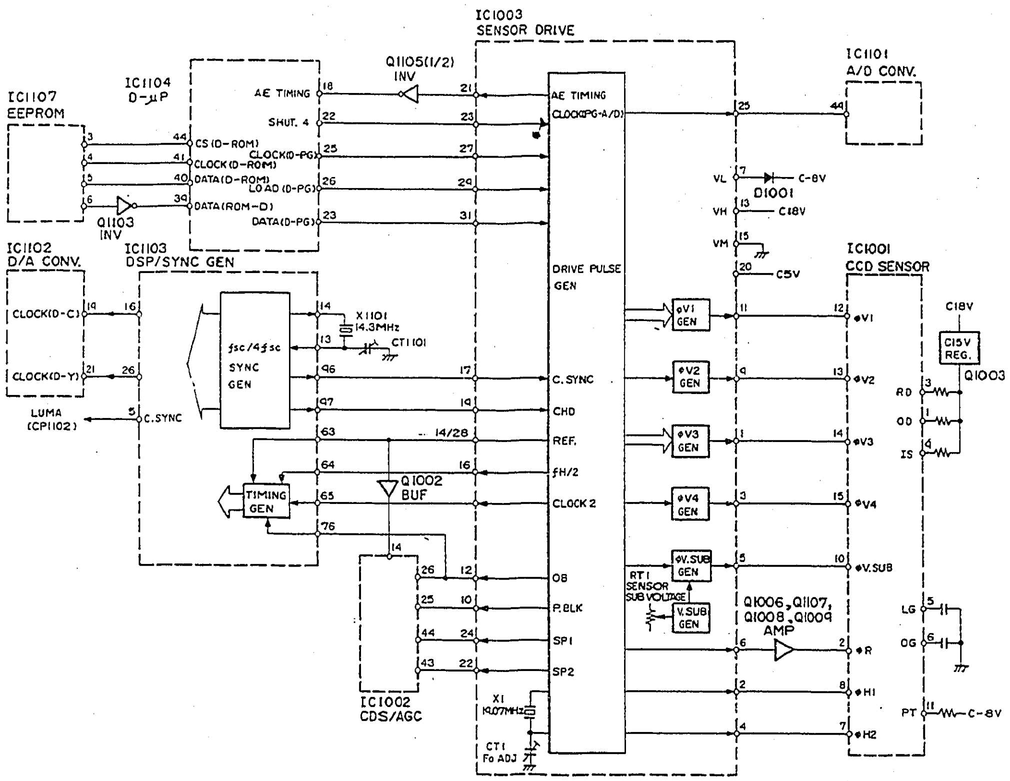


Fig. 2-4 Image Sensor Driver Circuit

(2) Over-flow Drain Bias (ϕV.SUB)
The over-flow drain is provided between each picture element to reduce blooming by preventing charges from entering the adjacent vertical shift register when excessive charge occurs due to a very bright subject and the charges occurring in non-storage period at shutter speeds other than 1/60 seconds.
The V.SUB voltage is supplied from the bias generator and adjusted by RT1 in IC1003 to the optimum voltage for each sensor chip.
When the shutter speed is other than 1/60 seconds, an overflow drain pulse is superimposed on the V.SUB voltage to discharge the charges in the photo sensors which occur in the non-storage period. When the shutter speed is set to 1/60 seconds, the photo sensor stores charges in the vertical blanking period and transfers them to the vertical shift register. When a shutter speed other than the 1/60 seconds is selected, the storage period and non-storage period occur in the vertical scanning period. When the shutter speed is set to the 1/100 seconds, for example, a non-storage period for approx. 6.7ms occurs in the first half of the vertical scanning period and a storage period for approx. 10ms occurs in the second half. The charges stored in the photo sensors in the non-storage period are discharged through the overflow drains when the overflow drain pulse is supplied.

(3) Horizontal Shift Register Clock Pulses (ϕH1 and ϕH2)
These are supplied to the horizontal shift register and time the transfer of charge from the horizontal shift register to the output circuit during the horizontal scanning period.

(4) Reset Pulse (ϕR)
This is supplied to the output circuit and times the resting of charge which remains in the output circuit after the previous scanning before the charge is transferred from the horizontal shift register to the output circuit during the horizontal scanning period.

(5) Biases
* Reset circuit drain voltage (pin 3: RD)
* Output circuit drain voltage (pin 1: OD)
* Output circuit source current (pin 9: IS)
* Output circuit load drain transistor gate voltage (pin 5: LG)
* Output circuit gate voltage (pin 6: OG)
* P-well voltage for protection (pin 11: PT)

5. SIGNAL PROCESSING CIRCUITS (Fig. 2-5 to 2-19)

The camera signal processing circuit consists of the CDS/AGC circuit (IC1002: CDS/AGC), analog-to-digital converter (IC1101: A/D CONV), digital signal processing circuit (IC1103: DSP), electronic zoom control (IC1110: ELECTRONIC ZOOM)and digital-to-analog converter (IC1102: D/A CONV).
The analog image sensor output signal supplied from IC1002 is converted to a 9-bit digital signal, separated into digital luminance and chrominance signals and processed. The processed digital luminance and chrominance signals are converted to an analog signal and supplied to the luma/chroma circuits in the VCR block. The characteristics of each circuit is controlled by the correction data supplied from a digital camera signal control microprocessor (IC1104: D-µP).
The output of the CCD sensor (IC1001: CCD SENSOR) is supplied through a buffer (Q1001: BUF) and pin 37 to IC1002. The output of IC1001 is a line sequential signal. That is, the Mg + Cy signal and G + Ye signal (called Sn signal hereafter) are generated alternately in the first horizontal period (A1) and the G + Cy signal and Mg + Ye signal (called Sn-1 signal hereafter) are generated alternately in the next horizontal period (A2). In the next horizontal period (A3), the Sn-2 signal the same as the Sn signal is generated. In the next field, the signal is generated sequentially as B1 and B2 by interlacing (See Fig. 2-6).

5-1. CDS/AGC Circuit (IC1002: CDS/AGC)

This reduces noise to improve the signal-to-noise ratio, produces a continuous signal and controls the gain of the image sensor output signal.

5-1-1. Data Communications

IC1002 inputs a serial gain control data from D-µP via pins 3 (DATA(D-AGC)) and 4 (CLOCK(D-AGC)) to control the gain of the AGC circuit.

5-1-2. CDS (Correlative Double Sampling) Circuit

The image sensor (IC1001) generates a noise portion and signal portion including noise alternately. The noise caused by IC1001 is mainly low frequency noise that is superimposed on the signal, affecting the signal-to-noise ratio (S/N). The CDS (Correlated Double Sampling) circuit removes low frequency noise by clamping the noise portion to a rated voltage when the SP1 pulse is supplied and produces a continuous signal by replacing the noise portion with the signal portion when the SP2 pulse is supplied.

5-1-3. Gain Selection Circuit (GAIN SELECT)

This corresponds to iris adjustment in the previous model (adjustment of the output level to 100IRE) and bypresses the gain variation of the camera. This adjusts the gain of the input signal of 1.5dB to 12dB. The gain control data is memorized in the EEPROM (IC1107) and read automatically when the power is first turned on.

5-1-4. AGC Circuit

The principle of this circuit is the same as that in the previous model (consisting of an AGC detector and amplifier) and controls an output signal level to keep it constant regardless of the input signal level. The difference is that the gain is controlled by an analog voltage supplied from digital-to-analog converter (D/A CONV), which is used instead of the AGC voltage generated by an AGC detector. This also operates when the iris is fully opened in the same way as that in the previous model.

5-1-5. Blanking Circuit (BLANK)

This mixes the P.BLK pulse supplied from pin 25 to suppress noise in the vertical and horizontal blanking periods. The output is supplied through amplifier (12.4dB) and pin 14 to the mixer. The mixer mixes the REF. pulse supplied from a buffer (Q1002: BUF) with the image sensor output signal and supplies it to IC1101 through a buffer (Q1104: BUF) and pin 36.

5-2. Analog-to-Digital Converter (IC1101: A/D CONV)

This converts the analog image sensor output signal to a digital signal using the 9.5MHz clock (CLOCK(PG-A/D)) pulse and supplies it to the digital signal processor (IC1103).

5-2-1. Comparator (COMPA.) and Encoder (ENCODE)

These sample the input signal, compare the input signal level with a reference voltage generated by a reference voltage generator (V.REF. GEN) and encode the compared signal.

5-2-2. Output Circuit (OUTPUT)

This supplies the 9-bit digital data to IC1103 via pins 12 (D8) to 53 (D0).

5-3. Digital Signal Processing Circuit (IC1103: DSP)

This consists of a line memory/matrixing circuit, filter, luma signal processing circuit, encoder, iris detecting circuit, R/G/B matrixing circuit, chroma signal processing circuit and white balance detecting circuit and processes the 9-bit digital data.

5-3-1. Data Communication

Two serial communication line are provided between IC1103 and IC1104 to transfer the operation state, iris and white balance control data. IC1103 and IC1104 are connected via seven data communication lines (DATA(D-DSP), CLOCK(D-DSP), LOAD(D-DSP), DATA(DSP(DET)-D), CLOCK(D-DSP(DET)), LOAD(D-DSP(DET)) and DATA(D-DSP(DET)).

(1) State Data Reception
The DATA(D-DSP) is received synchronized with the CLOCK(D-DSP) pulse. The DATA(D-DSP) is latched by LOAD(D-DSP) after completing the data transfer. This data transfer is performed to set the initial state of each circuit when the power is first turned on.

(2) Data Reception for Iris and White Balance States and Data Transfer for Detected Data

The DATA(D-DSP(DET)) is received synchronized with the CLOCK(D-DSP(DET)) pulse. DATA(D-DSP(DET)) is latched by LOAD(D-DSP(DET)) after completing the data transfer. DATA(D-DSP(DET)) is data for controlling the iris and white balance detection circuits. The DATA(DSP(DET)-D) is detected data of the iris and white balance detection circuits and is transferred synchronized with CLOCK(D-DSP(DET)) to IC1104.

(3) Iris and White Balance Control Pulse Outputs (Fig. 2-13)

The iris detecting area (AREA1 to AREA3) pulses and vertical sync (FV) pulse are timing pulses to detect the iris detecting areas. The FV pulse is also used to detect the white balance.

5-3-2. Line Memory/Matrixing Circuits (LINE MEMORY/MATRIX, Fig. 2-6)

These input 9-bit image sensor output signal via pins 66 (D8) to 74 (D0), delayes it by 1H and 2H using two horizontal line memories (1H delay) and process three horizontal line signals (nondelayed, 1H delayed and 2H delayed signals).

(1) 2H Line Memory (2H LINE MEMORY)

This delays the input signal by 1H and 2H and generates the three signals, non-delayed, 1H delayed and 2H delayed.

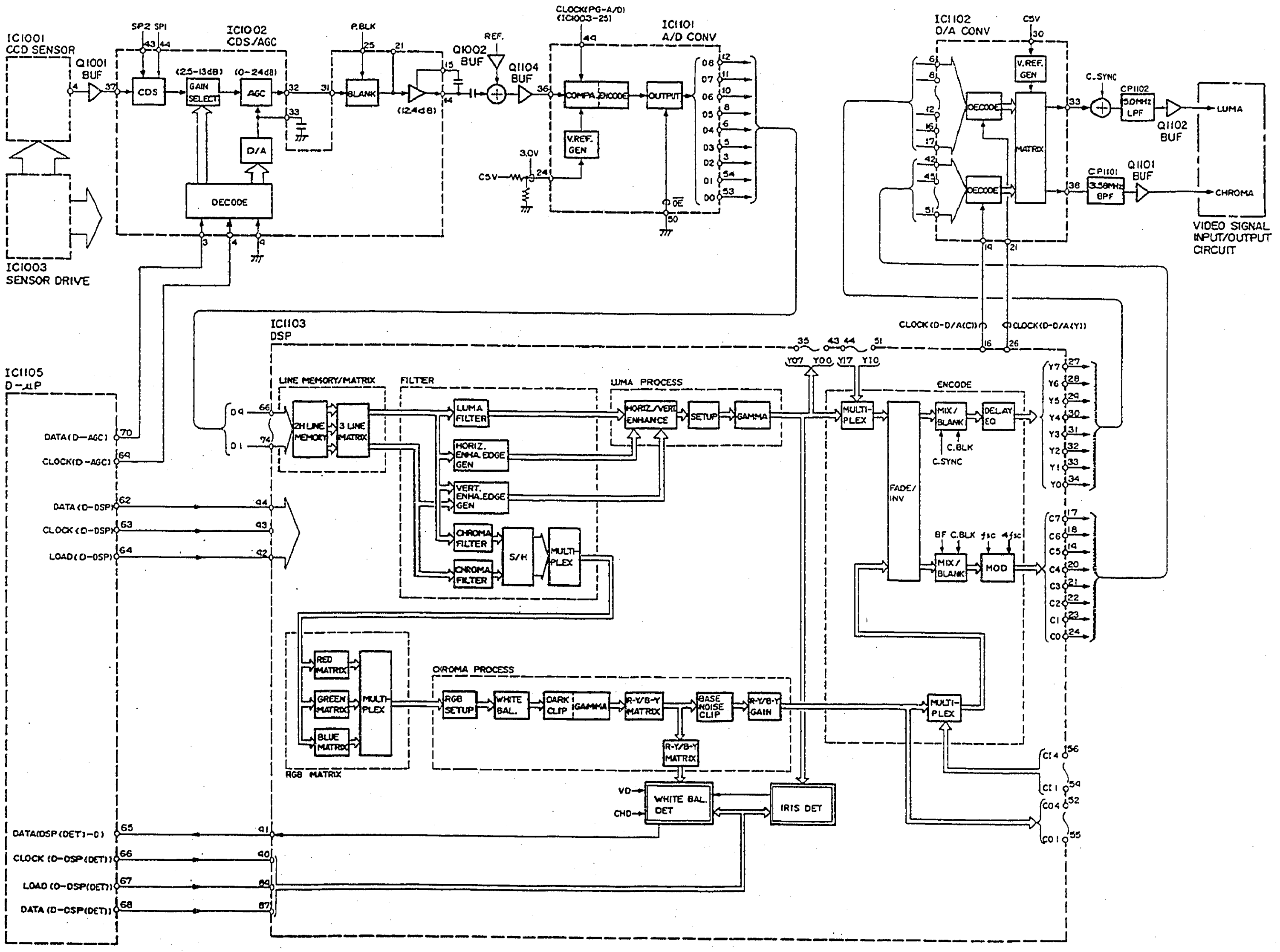

IC1001
CCD SENSOR
Q1001
BUF
SP2 SP1
IC1002
CDS/AGC
CDS
(2.5-13dB)
GAIN SELECT
(0-24dB)
AGC
D/A
DECODE
P.BLK
BLANK
(12.4dB)
REF.
Q1002
BUF
Q1104
BUF
CLOCK(PG-A/D)
(IC1003-25)
IC1101
A/D CONV
COMPA.
ENCODE
OUTPUT
V.REF.
GEN
3.0V
C5V
OE
D8
D7
D6
D5
D4
D3
D2
D1
D0
IC1003
SENSOR DRIVE
IC1102
D/A CONV
C5V
V.REF.
GEN
DECODE
MATRIX
DECODE
C.SYNC
CP1102
5.0MHz
LPF
Q1102
BUF
LUMA
CP1101
3.58MHz
BPF
Q1101
BUF
CHROMA
VIDEO SIGNAL
INPUT/OUTPUT
CIRCUIT
CLOCK(D-D/A(C))
CLOCK(D-D/A(Y))
IC1103
DSP
IC1105
D-μP
DATA(D-AGC)
CLOCK(D-AGC)
DATA(D-DSP)
CLOCK(D-DSP)
LOAD(D-DSP)
DATA(DSP(DET)-D)
CLOCK(D-DSP(DET))
LOAD(D-DSP(DET))
DATA(D-DSP(DET))
D9
D1
LINE MEMORY/MATRIX
2H LINE MEMORY
3 LINE MATRIX
FILTER
LUMA FILTER
HORIZ. ENHA. EDGE GEN
VERT. ENHA. EDGE GEN
CHROMA FILTER
CHROMA FILTER
S/H
MULTI-PLEX
LUMA PROCESS
HORIZ./VERT. ENHANCE
SETUP
GAMMA
Y07 Y00 Y17 Y10
ENCODE
MULTI-PLEX
FADE/INV
MIX/BLANK
DELAY EQ
C.BLK
C.SYNC
BF C.BLK fsc 4fsc
MIX/BLANK
MOD
Y7 Y6 Y5 Y4 Y3 Y2 Y1 Y0
C7 C6 C5 C4 C3 C2 C1 C0
RED MATRIX
GREEN MATRIX
BLUE MATRIX
MULTI-PLEX
RGB MATRIX
CHROMA PROCESS
RGB SETUP
WHITE BAL.
DARK CLIP
GAMMA
R-Y/B-Y MATRIX
BASE NOISE CLIP
R-Y/B-Y GAIN
R-Y/B-Y MATRIX
MULTI-PLEX
VD
CHD
WHITE BAL. DET
IRIS DET
C14
C11
C04
C01

Fig. 2-5 Digital Camera Signal Processing Circuit

(2) 3 Line Matrixing Circuit (3 LINE MATRIX)

This matrixes three signals and generates two 1H delayed signals.

5-3-3. Filter (FILTER, Figs. 2-5 to 2-9)

This consists of a luma signal filter, chroma signal filter and color separation circuit.

(1) Luma Signal Lowpass Filter (LUMA LPF)

This extracts the luma signal and limits the bandwidth. The output signal is supplied to the luma signal processing circuit as the main luma signal.

(2) Horizontal Edge Enhance Signal Generator (HORIZ. EDGE ENHA. GEN, Fig. 2-7)

This corresponds to the horizontal aperture correction circuit which uses a delay line in the previous model and generates a horizontal edge enhance signal by subtracting the non-delayed (2) and 210ns delayed (4) signals from the 105ns delayed signal (3).

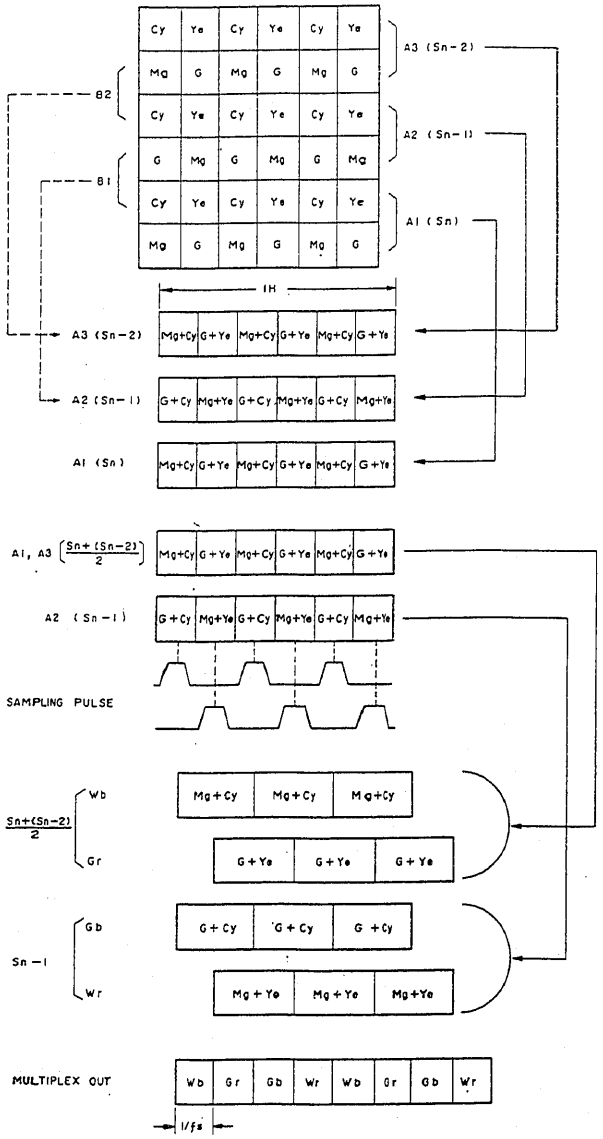

Cy Ye Cy Ye Cy Ye
Mg G Mg G Mg G
Cy Ye Cy Ye Cy Ye
G Mg G Mg G Mg
Cy Ye Cy Ye Cy Ye
Mg G Mg G Mg G
B2
B1
A3 (Sn-2)
A2 (Sn-1)
A1 (Sn)
1H
A3 (Sn-2)
Mg+Cy G+Ye Mg+Cy G+Ye Mg+Cy G+Ye
A2 (Sn-1)
G+Cy Mg+Ye G+Cy Mg+Ye G+Cy Mg+Ye
A1 (Sn)
Mg+Cy G+Ye Mg+Cy G+Ye Mg+Cy G+Ye
A1, A3 $\left[\frac{Sn+(Sn-2)}{2}\right]$
Mg+Cy G+Ye Mg+Cy G+Ye Mg+Cy G+Ye
A2 (Sn-1)
G+Cy Mg+Ye G+Cy Mg+Ye G+Cy Mg+Ye
SAMPLING PULSE
$\frac{Sn+(Sn-2)}{2}$
Wb
Mg+Cy Mg+Cy Mg+Cy
Gr
G+Ye G+Ye G+Ye
Sn-1
Gb
G+Cy G+Cy G+Cy
Wr
Mg+Ye Mg+Ye Mg+Ye
MULTIPLEX OUT
Wb Gr Gb Wr Wb Gr Gb Wr
1/fs

Fig. 2-6 Chrominance Signal Processing

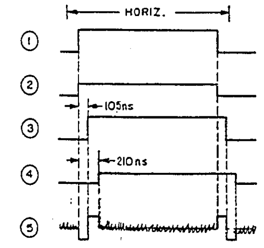


Fig. 2-7 Horizontal Edge Enhancer

(3) Vertical Edge Enhance Signal Generator (VERT. EDGE ENHA. GEN, Fig. 2-8)

This generates a vertical edge enhance signal (3) by subtracting the non-delayed and 2H delayed signal added signal ((Sn + Sn-2)/2 (2)) from the 1H delayed (Sn-1) signal (1). The output signal contains a small amplitude noise component.

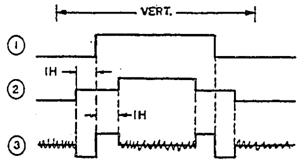


Fig. 2-8 Vertical Edge Enhancer

(4) Chroma Filter (CHROMA FILTER)

This extracts the chroma signal and limits the bandwidth.

(5) Color Separation Circuit (S/H, Fig. 2-6)

This inputs two signals; one is the added and divided ((Sn + (Sn-2)/2) signal and the other is the 1H delayed (Sn-1) signal; it sample-holds the input signals using two sampling pulses. The output signals are continuous complimentary signals (Wr, Gb, Gr and Wb).

(6) Multiplexer (MULTIPLEX, Fig. 2-6)

This selects four inputs signals using switches and generates dot sequential (Wr/Gr/Gb/Wb) signals.

5-3-4. Luma Signal Processing Circuit (LUMA PROCESS, Figs. 2-5 and 2-10 to 2-11)

This consists of horizontal and vertical enhancers, setup level control circuit and gamma correction circuit.

(1) Horizontal and Vertical Enhancer (ENHANCE, Fig. 2-9)

The horizontal and vertical enhancers emphasize middle and high frequency components of horizontal and vertical signals to compensate for deteriorated frequency response caused by the crystal filter which is used to reduce moire, etc. The enhancers remove small amplitude noise contained in the horizontal and vertical edge enhance signals. The circuit consists of horizontal and vertical edge enhance signal compensation circuits and adder.

1) Horizontal Edge Enhance Signal Compensation Circuit (HORIZ. ENHA. COMPE.)

This consists of base noise clip, enhance coefficient and noise coefficient circuits and an adder.

The characteristics of the base noise clip circuit are determined by digital data. The width of base clip (between "a" and "-a") is set by the data, the bias within base clip width is set by the data supplied to the noise coefficient (NOISE κ) circuit and the bias without base clip width is set by data supplied to the enhance coefficient (ENHANCE κ) circuit. Both signals from the coefficient circuits are added at the adder (ADD1). By these processes, the horizontal edge enhance signal whose small amplitude noise components are attenuated and amplitude of enhance signal is controlled, is obtained.

2) Vertical Edge Enhance Signal Compensation Circuit (HORIZ. ENHA. COMPE.)

This consists of base noise clip and enhance coefficient circuits and operates the same as the horizontal edge enhance signal compensation circuit. The output is added to the horizontal edge enhance signal by the adder (ADD2) and then supplied to the adder.

3) Adder (ADD3)

This adds the horizontal and vertical edge enhance signals to the luma signal and generates the luma signal of which the horizontal and vertical edges are enhanced.

(2) Setup Level Control Circuit (SETUP)

This controls the setup level of the luma signal.

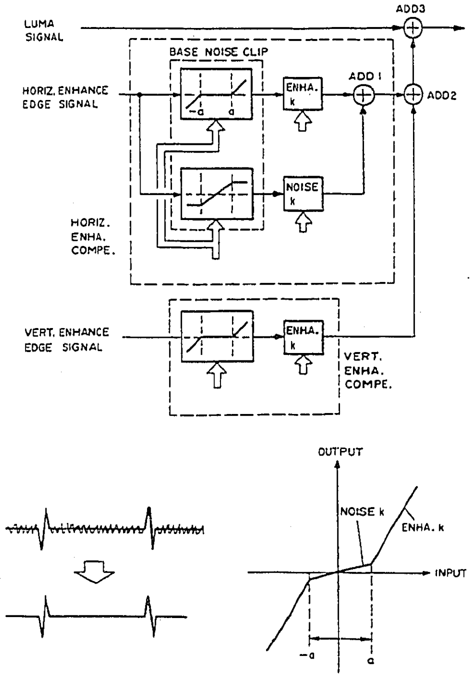


Fig. 2-9 Base Noise Clipping

(3) Gamma Correction Circuit (GAMMA, Figs. 2-10 and 2-11)

The gamma correction circuit applies the gamma characteristics of 0.45 (1/2.2) to obtain linear gamma characteristics ($\gamma = 1$) overall as the gamma characteristic of the CRT is 2.2 and the gamma characteristic of the CCD sensor ($\gamma = 1$). The principle of gamma correction is the same as in the previous model.
The gamma correction circuit consists of ROM, gamma coefficient circuit and adder.

1) ROM (ROM DATA)
This holds the gamma characteristics ($\gamma = 0.4545$) output from IC1107 (EEPROM). The S-curve characteristic is applied at low level luma signal input to reduce noise at the black level.

2) Gamma Coefficient (κ)
This applies the coefficient to the gamma characteristics to obtain eight gamma characteristics (8-step, $\gamma = 0.4545$ to $\gamma = 1$). The gamma correction signal is supplied to the adder.

3) Adder (ADD)
This adds the gamma correction signal to the luma signal.

5-3-5. Encoder (ENCODER, Figs. 2-5)

The luma signal is supplied to the fader/inverter through the multiplexer (MULTIPLEX).

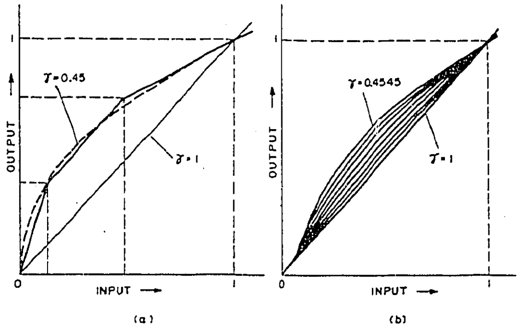
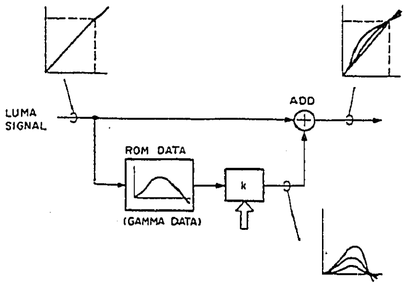


Fig. 2-10 Gamma Characteristics



LUMA SIGNAL
ADD
ROM DATA
(GAMMA DATA)
k

Fig. 2-11 Luminance Signal Gamma Correction

(1) Fader/Inverter (FADE/INV, Fig. 2-12)

This fades in and out the luma signal and inverts the luma signal to obtain the negative and positive luma signals.

1) Fade In and Fade Out
This fades in and out the luma signal with the chroma signal synchronized with the audio signal. This fade in and out is called a white fade. The fading in and out time is set to approx. 3s.

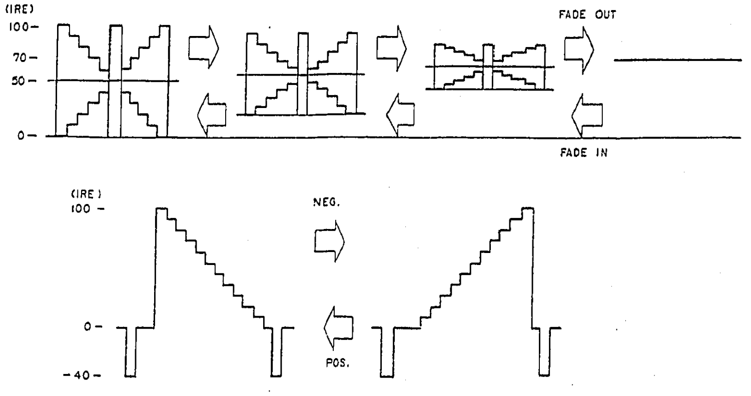
2) Negative/Positive Inversion
This generates negative or positive luma signal with the chroma signal.

(2) Mix/Blanking Circuits (MIX/BLANK)

This mixes the C.SYNC and C.BLK pulses with the luma signal to attenuate noise as clock pulses remain in the blanking period.

(3) Delay Equalizer (DELAY EQ)

This delays the luma signal to match the delay time to that of the chroma signal. The 8-bit digital luma signal output at pins 29 (Y7) to 34 (Y0) is supplied to the digital-to-analog converter.



(IRE)
100
70
50
0
FADE OUT
FADE IN
(IRE)
100
0
-40
NEG.
POS.

Fig. 2-12 Fade and Nega./Posi. Invertion

5-3-6. Digital AI Automatic Iris Control Circuit (Figs. 2-13 and 2-14)

This consists of an iris detection circuit (IRIS DET) in the digital signal processing circuit (IC1103: DSP), digital microprocessor (IC1104: DSP), iris motor driver (IC1105: MOTOR DRIVE) and EEPROM (IC1107).

(1) Iris Detection and Iris Motor Drive Circuit (Fig. 2-13)

The luma signal output from the gamma correction circuit in IC1103 is supplied to the weighting circuit.

1) Weighting Circuit (WEIGHT)
This uses software in IC1104 to apply a weighting coefficient to the luma signal of each detecting area. The value of weighting coefficient changes depending on the area. There are four weighting coefficients (for areas (1) and (2), (3) and (4), (5) and (6)).

2) Area Average Detector (AREA AVERAGE DET)
This detects the average level of the input signal of each area using the area pulses generated by the area pulse generator.

3) Peak Detector (PEAK DET)
This detects the peak value of the input signal of each area.

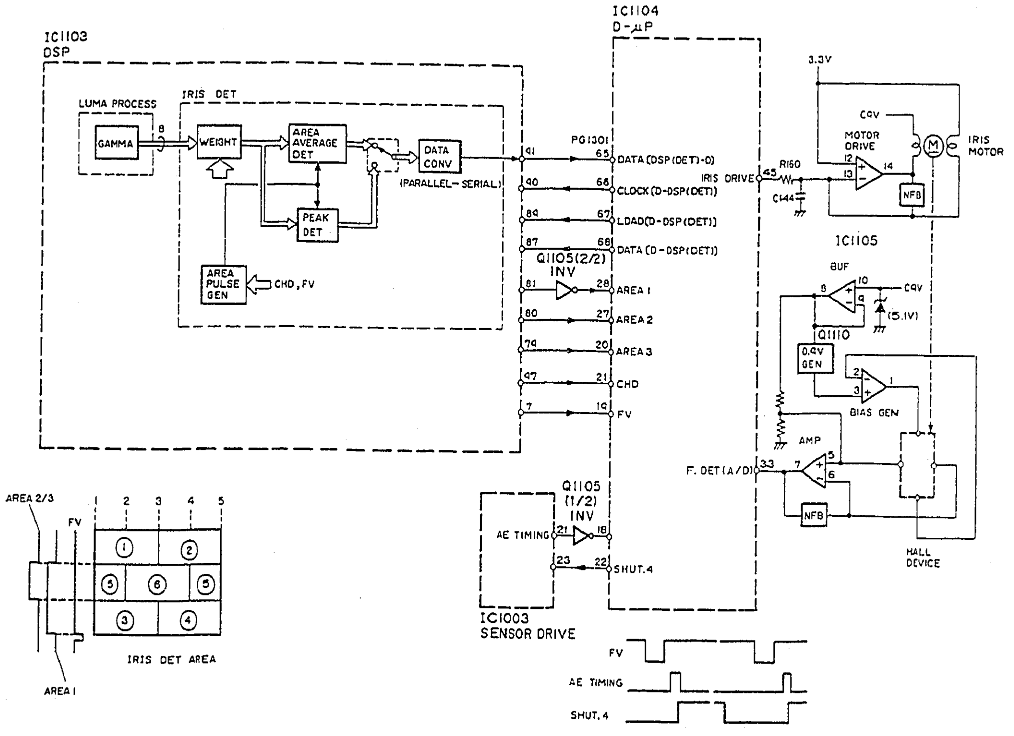
4) Detected Data Selection Circuit
This selects the average or peak data depending on the state data from IC1104.

5) Data Converter (DATA CONV)
This converts the parallel data to serial data and supplies it to IC1104 via pin 91.

6) Area Pulse Generator (AREA PULSE GEN)
This generates pulses which determine the detecting area using the CHD and FV pulses generated by the sync generator in IC1103.

7) Iris Motor Control Circuit (IC1104: D-μP)
This inputs the digital detection signal, calculates and determines the duty ratio, and generates a pulse width modulated (IRIS DRIVE) signal at pin 45.

8) Iris Motor Driver (IC1105: AIC/F.DET)
The IRIS DRIVE signal at pin 45 of IC1104 is integrated by C144 and R160 and then its average level is supplied to pin 13 (-) of iris driver in IC1105. This IRIS DRIVE signal is inversely amplified and supplied to the iris motor via pin 14. This motor drive voltage is inversely proportional to the level of the IRIS DRIVE signal. The iris motor operates by the voltage difference between C9V and the motor drive voltage at pin 14 of IC1105. Therefore, the iris opens (closes) as the level of the IRIS DET signal decreases (increases).
The damper in the iris motor generates an electromotive voltage depending on the motor speed and position of the iron piece, which fed back to the iris driver to maintain the iris opening.



IC1103
DSP
IC1104
D-μP
LUMA PROCESS
GAMMA
IRIS DET
WEIGHT
AREA AVERAGE DET
PEAK DET
DATA CONV
(PARALLEL-SERIAL)
AREA PULSE GEN
CHD, FV
DATA (DSP(DET)-D)
CLOCK (D-DSP(DET))
LOAD(D-DSP(DET))
DATA (D-DSP(DET))
Q1105(2/2)
INV
AREA 1
AREA 2
AREA 3
CHD
FV
IRIS DRIVE
R160
C144
3.3V
C9V
MOTOR DRIVE
IRIS MOTOR
NFB
IC1105
BUF
Q1110
0.9V GEN
(5.1V)
BIAS GEN
AMP
F. DET (A/D)
HALL DEVICE
Q1105 (1/2)
INV
AE TIMING
SHUT.4
IC1003
SENSOR DRIVE
AREA 2/3
AREA 1
IRIS DET AREA
FV
AE TIMING
SHUT.4

Fig. 2-13 AI Automatic Iris Control Circuit

(2) Actual Operation

IC1104 transfers DATA(D-DSP(DET)) via pin 16 to IC1103, receives detected luma signal data via pin 13 (DATA(DSP(DET)-D) and calculates the detected data to control the iris opening. IC1104 inputs area detecting pulses via pins 28 (AREA1) to 19 (FV) to detect the data of each area. The following operation will be performed.

1) Data Input

IC1104 reads the average data of areas 1 and 2 sequentially at the leading edge of the AREA1 pulse. The border of areas 1 and 2 is determined by horizontal count number 3 of the iris detection state data. IC1104 reads the average data of areas 5 and 6 sequentially at the trailing edge of the AREA2 and AREA 3 pulses. The border of areas 5 and 6 is determined by horizontal count number 2 and 4. Then IC1104 reads the average data of areas 3 and 4 sequentially at the trailing edge of the FV pulse. The border of areas 3 and 4 is determined by horizontal count number 3. The peak data of the commanded area is also read.

2) Iris and AGC Control

IC1104 calculates each data and determines the iris and AGC control data.

a) Luma Signal Data and Reference Data Calculation

IC1104 calculates luma signal data and reference data as follows.

$$\text{Y level} = ((Y1+Y2)\times\kappa1) + ((Y3+Y4)\times\kappa2) + (Y5\times\kappa3) + (Y6\times\kappa4)$$

$$\text{Y ref.} = ((\text{REF.}1+\text{REF.}2)\times\kappa1) + 9(\text{REF.}3+\text{REF.}4)\times\kappa2) + (\text{REF.}5\times\kappa3) + (\text{REF.}6\times\kappa4)$$

($\kappa1$ to $\kappa4$: weighting coefficients)

b) Iris Opening Detection

IC1104 inputs the F.DET voltage and judges whether the iris is fully open or not. When the iris is fully open, IC1104 controls the AGC and when it is not, IC1104 controls the iris opening.

AGC Control

IC1104 generates a 100% (PWM) IRIS DRIVE signal, and the iris is fixed to fully open. Then, IC1104 controls the gain of the AGC circuit depending on the luma signal data. IC1104 also limits the AGC gain when it exceeds the maximum AGC gain that is memorized in IC1107.

3) Iris Drive Signal Control

IC1104 determines the duty ratio of the IRIS DRIVE signal based on the reference data that corresponds to 50IRE. The duty ratio is calculated as follows.

$$\text{DUTY} = \text{CDUTY} + (\text{Yref.} - \text{Ylevel})\times\kappa$$

(CDUTY is data memorized in IC1107 (100IRE automatic level adjustment), κ; coefficient)

IC1104 limits the duty ratio of the IRIS DRIVE signal so it does not exceed 0% and 100%, pulse width modulates it and supplies it to pin 45.

(3) F Value Detector (IC1105: F.DET, Fig. 2-14)

This consists of the Hall device, bias generator and F value amplifier and generates the F.DET voltage supplied to pin 33 (F.DET(A/D)) of IC1104. IC1104 detects the F value by comparing the detected F.DET voltage and F.DET data memorized in IC1107.

1) Hall Device (HALL DEVICE)

This is installed to the iris in the iris motor and generates a voltage corresponding to the iris opening.

2) Bias Generator (BIAS GEN)

This is a constant current source and supplies a bias current to the Hall device. The Zener diode (D103: 5.1V) supplies 5.1V through a buffer (IC1105: BUF) to the 0.9V generator (Q1110: 0.9V GEN). 0.9V is supplied to the bias generator (IC1105: BIAS GEN) which supplies constant current to the Hall device.

3) F Value Amplifier (AMP)

This amplifies the output of the Hall device and supplies it to pin 33 (F.DET(A/D)). This F.DET voltage is approx. 3V when the iris is fully opened and approx. 1V when the iris is closed. IC1104 converts the F.DET voltage to digital data, compares it with the reference data memorized in IC1107 and detects the F value.

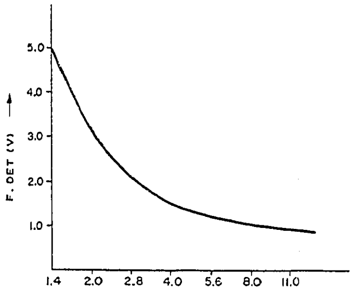


Fig. 2-14 F Value vs F.DET

5-3-7. RGB Matrixing Circuit (Figs. 2-5 and 2-15)

This consists of an RGB matrixing circuit and multiplexer and produces the red, green and blue signals using matrix coefficients supplied from IC1104.

(1) R/G/B Matrixing Circuit (RED/GREEN/BLUE MATRIX)

This produces red, green and blue signals from four complementary signals (Wb, Gr, Gb and Wr) independently by applying each matrixing coefficient.

(2) Multiplexer (MULTIPLEX)

This produces a continuous signal from three primary color signals using the 4.2MHz clock pulse.

5-3-8. Chroma Signal Processing Circuit (CHROMA PROCESS, Figs. 2-5, 2-15 and 2-16)

This inputs three primary color signals, produces two color deference signals (R-YL and B-YL) and supplies them to the encoder and white balance detection circuit.

(1) RGB Setup Level Control Circuit (RGB SETUP)

This sets the setup level of each of the three primary color signals.

(2) White Balance Circuit (WHITE BAL.)

This sets the gain of each of the three primary color signals when the power is first turned on. After that, the gain of red and blue signals are controlled by the output of the digital AI white balance control circuit to maintain the white balance. The gain of the green signal is fixed.

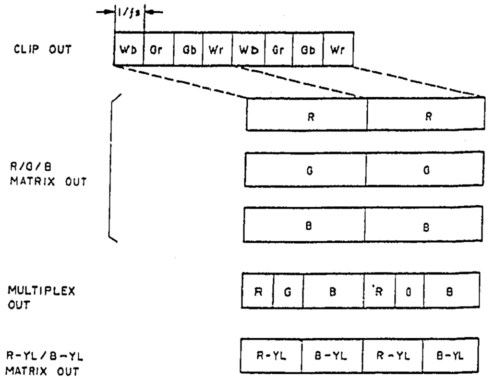


Fig. 2-15 Color Signal Processing

(3) Dark Clip/Gamma Correction Circuits (DARK CLIP/GAMMA, Fig. 2-16)

This applies gamma correction to each of the three primary color signals in the same way as in the luma signal processing circuit. This also clips dark portion of the three primary color signals. The circuit consists of two ROMs, a dark clip coefficient circuit, subtracter, gamma coefficient circuit and adder.

1) ROM1

This contains the chroma dark clip characteristics memorized in IC1107 and sets the dark clip level.

2) Dark Clip Coefficient Circuit (κ)

This applies dark clip coefficient and generates 8-step characteristics.

3) Subtracter (SUB.)

This subtracts the dark clip characteristics from the chroma signal to clip dark portions.

4) ROM2

This contains the gamma characteristics memorized in IC1107.

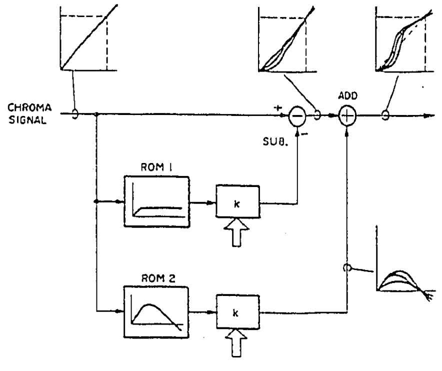


Fig. 2-16 Chrominance Signal Gamma Correction

5) Gamma Coefficient Circuit (κ)

This applies the coefficient to the gamma characteristics and generates 8-step gamma characteristics.

6) Adder

This adds the gamma characteristics to the dark clipped chroma signal to generate a gamma corrected chroma signal.

(4) R-YL/B-YL Matrixing Circuit (R-Y/B-Y MATRIX)

This matrixes the three primary color signals to generate two color difference signals (R-YL and B-YL).

(5) Base Noise Clip Circuit (BASE NOISE CLIP)

This clips base noise contained in the two difference signals.

(6) R-YL/B-YL Gain Control Circuit (R-Y/B-Y GAIN)

This controls the gains of two color difference signals.

(7) R-Y/B-Y Gain Control Circuit (R-Y/B-Y GAIN)

This also controls the gains of the two color difference signals supplied to the white balance detection circuit.

5-3-9. Encoder (ENCODE, Fig. 2-5)

This consists of a fade/inversion circuit, mixing/blanking circuits and modulator and generates a 3.58MHz digital chroma signal.

(1) Fade/Inversion Circuit (FADE/INV)

The operation is the same as that in the luma signal processing circuit.

(2) Mixing/Blanking Circuits (MIX/BLANK)

This adds the burst flag (BF) and C.BLK pulses.

(3) Modulator (MOD)

This modulates two color difference signals using the fsc and 4fsc pulses. This also sets the pedestal, sync tip and B-YL burst levels.

5-3-10. Digital AI White Balance Control Circuit (Figs. 2-17 and 2-18)

(1) Circuit Configuration and Operation

The white balance detection circuit inputs two color difference signals (R-YL and B-YL) the gain of which has been controlled.

1) Adder/Subtracter (+/-)

This subtracts the B-YL signal from the R-YL signal to generate the R-B signal and adds the R-YL and B-YL signals to generate the Mg-G signal.

$$(R\text{-}YL) - (B\text{-}YL) = R\text{-}B$$
$$(R\text{-}YL) + (B\text{-}YL) = R+B\text{-}2YL = Mg\text{-}G$$

The R-B signal is used to detect the color temperature and the Mg-G signal is used to detect an artificial light source such as a fluorescent lamp.

2) White Detection Circuit (WHITE DET)

This extracts the signal for detecting white from the input signal. The state data is transferred from the white detection control circuit in IC1104.

3) Integration Circuit (INTEGRATION)

This integrates the input signal to generate two integrated signals (R-B and Mg-G).

4) Data Converter (DATA CONV)

This converts parallel data to serial data to supply it to IC1104 via pin 91. The serial data of both signals are read after 3H has passed since the FV pulse has gone "Lo".

5) Up/Down Counter (UP/DOWN)

This counts up or down depending on the level of the input signal. This also controls the speed of counting.

6) White Balance Gain Control Counter (GAIN COUNT)

This generates gain control data supplied to the white balance control circuit in IC1103.

7) White Balance Detection Control Circuit (WHITE BAL. CONTROL)

This generates the gate pulse for extracting white. The white gate pulse is changed depending on the subject by detecting the output of the R-B/Mg-G counter, F.DET voltage, AGC gain, shutter speed, etc.

8) White Balance Gain Control Counter (GAIN COUNT)

This controls the gain of the red and blue signals to maintain the white balance.

(2) Actual Operation

IC1104 transfers the state data (DATA(D-DSP(DET))) to IC1103, receives integrated data via pin 65 (DATA(DSP(DET)-D)) and controls the gains of the red and blue signals to maintain the white balance. The following operations will be performed.

1) Data Read

IC1104 reads the integrated data (R-B and Mg-G).

2) Calculation

IC1104 compares the R-B signal and the reference signal (reference color temperature: 4,500K), detects the color temperature and transfers the state data to the white balance control circuit in IC1103. The state data that reduces (increases) the red gain when the color temperature is higher (lower). At the same time, IC1104 calculates the gain of the blue signal by detecting the color temperature. The color temperature is obtained by detecting the gain difference between color temperature axis and red gain.

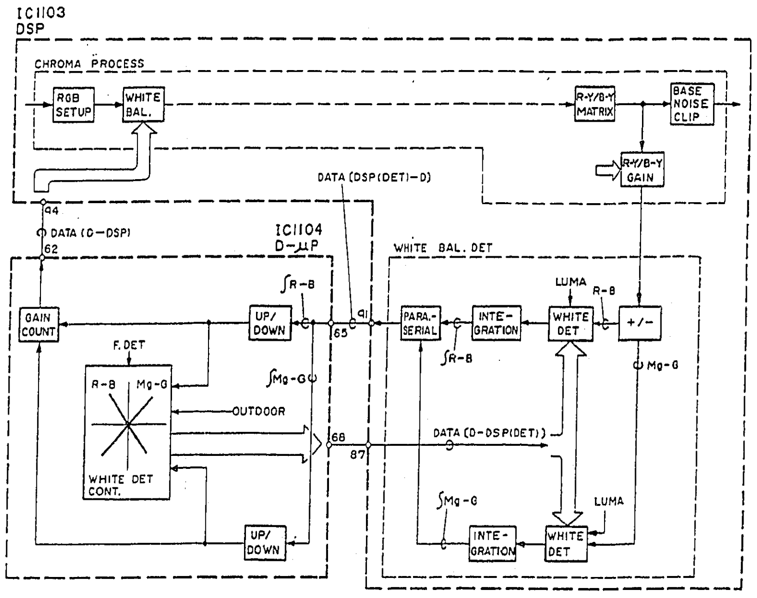


Fig. 2-17 AI Automatic White Balance Control

3) White Extraction Calculation

IC1104 inputs the iris detection data from the iris detection circuit and luma signal data, calculates the luma signal level and determines the threshold level. IC1104 judges whether the subject is indoor or not by detecting the illumination using the the iris data and shutter speed data and determines the white detection area.

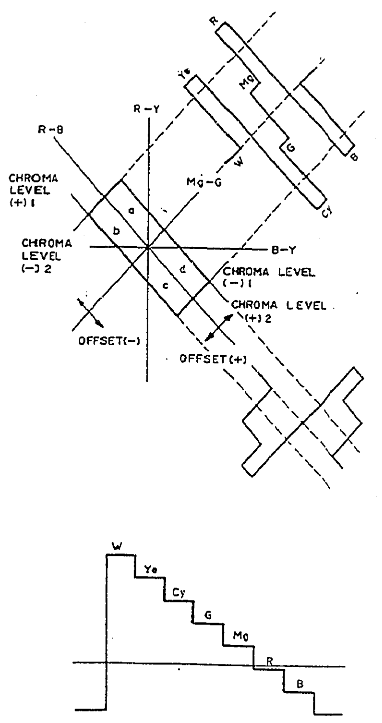


Fig. 2-18 White Balance Detection

5-3-11. Automatic Picture Control (Fig. 2-19)

The automatic picture control circuit is provided to maintain the best picture quality depending on the condition of the subject. The condition of the subject is detected by the illumination of the subject (using AGC gain) and the color temperature. The picture quality control depends on the area. The area of AGC gain is divided by 6 and the color temperature is divided by 12.

(1) Low Light Edge Enhance Compensation

As the level of the edge enhance signal is high in low light conditions, the edge enhancement of the picture becomes too great. To prevent this, the circuit detects the illumination and decreases (increases) the gain of the edge enhance signal as the illumination is lower (higher).

(2) Low Light Chroma Suppression

As the chroma signal is high in low light conditions, chroma noise appears. To prevent this, the circuit decreases the chroma gain (R-YL/B-YL signal gain) as light is lower (in the AGC control area).

(3) Low Light Base Noise Clip Compensation

This increases the amount of the base noise clip to reduce noise contained in the chroma signal depending on the illumination.

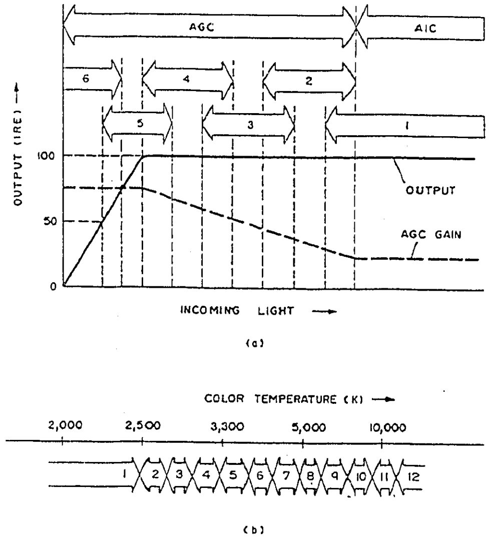


Fig. 2-19 Control Areas

5-4. Digital-to-Analog Converter (IC1102: D/A CONV, Fig. 2-5)

This converts the digital luma and chroma signals to analog signals and supplied them to the luma/chroma circuits.

5-4-1. Decoder (DECODE)

This decodes the 8-bit digital luma signal supplied from pins 6 (Y7) to 17 (Y0) using the CLOCK(DSP-D/A(Y)) pulse supplied to pin 21 and the 8-bit chroma signal supplied from pins 42 (C7) to 51 (C0) using the CLOCK(DSP-D/A(C)) pulse supplied from pin 19.

5-4-2. Matrixing Circuit (MATRIX)

This converts the decoded luma and chroma signals to analog signals using the DC voltage generated by the reference voltage generator (V.REF. GEN).

(1) Luma Signal Output Circuit

The luma signal is output at pin 33 and the C.SYNC pulse is added to the luma signal. The luma signal is then supplied through a 5.0MHz lowpass filter (CP1102: 5.0MHz LPF) which eliminates noise such as the clock pulse and limits the bandwidth of the luma signal and buffer (Q1102: BUF), to the luma/chroma circuits.

(2) Chroma Signal Output Circuit

The chroma signal is output at pin 38 and is supplied to the 3.58MHz bandpass filter (CP1101: 3.58MHz BPF) which attenuates unnecessary components such as the clock pulse and extracts the 3.58MHz ±500kHz chroma signal. The output is supplied through a buffer (Q1101: BUF) to the luma/chroma circuits.

6. MANUAL /ELECTRONIC ZOOM CONTROL CIRCUIT

6-1. General

Two zoom systems are provided. One is motor drive zoom system whose maximum zoom ratio is 8X. The other is elelctronic zoom system whsoe zoom ratio is from 8X to 16X in zoom mode 1 and from 16X to 64X in zoom mode 2. Both systems are controlled by three bottons of ZOOM MODE, WIDE (W) and TELE (T). The electronic zoom system is new function and operates when the zoom ratio reaches 8X or more.
The electronic zooming operation is performed by a sensor driver (IC1103: SENSOR DRIVER) and an electronic zoom circuit (IC1110: ELECTRONIC ZOOM) which are controlled by a digital microprocessor (IC1104: D-µP).

The vertical scanning area (vertical expansion) is controlled by IC1003 and the horizontal scanning area (horizontal expansion) is controlled by IC1110.

6-2. Zoom Motor Control Circuit (Fig. 2-20)

The zoom ratio is controlled by movinig the zoom lens in the lens block. The moving of the lens is controlled by the zoom motor which is controlled by a digital camera signal control microprocessor (D-µP). The D-µP monitors the operations of WIDE and TELE bottons at input pins 71 and 72. The D-µP has two zoom motor control output pins 74 (TELE) and 7 (WIDE), and these outputs are supplied througth a motor driver circuit (Q106-Q109) to the zoom motor. When the TELE or WIDE botton is not pressed, both outputs become Lo causing four transistors Q106 to Q109 to turn off. When the TELE botton is pressed, TELE control pin 74 becomes Hi, causing two transistors Q106 and Q109 to turn on. When the WIDE botton is pressed, The WIDE control pin 7 becomes Hi causing two transistors Q107 and Q108 to turn on.

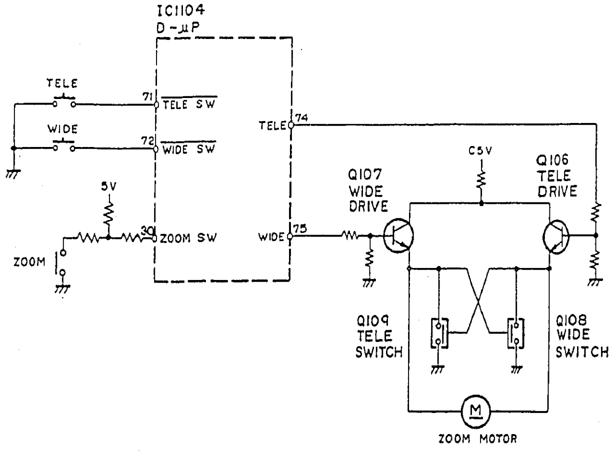

IC1104
D-µP
TELE
WIDE
71
TELE SW
72
WIDE SW
5V
30
ZOOM SW
ZOOM
TELE
74
WIDE
75
C5V
Q107
WIDE
DRIVE
Q106
TELE
DRIVE
Q109
TELE
SWITCH
Q108
WIDE
SWITCH
M
ZOOM MOTOR

Fig. 2-20 Zoom Motor Driver

6-3. Electronic Zoom Control Circuit (Fig. 2-21 and 2-22)

This consists of a sensor driver, electronic zoom circuit, digital signal processing circuit and the digital microprocessor.

6-3-1. Vertical Scanning Area (Vertical Expansion) Control Circuit

The vertical expansion is controlled by the sensor driver (IC1003: SENSOR DRIVE). IC1003 communicates with IC1104 via three communications lines, DATA(D-PG), LOAD(D-PG) and CLOCK(D-PG). IC1003 receives the vertical start and stop data that determines the scanning area. The photoelectrons charged in each picture elements which are outside of the scanning area, are swept and output in the vertical blanking period. Therefore, the photoelectrons charged in each picture element are read out during vertical scanning period. There are 256 horizontal lines in the vertical direction in the CCD sensor and the number of horizontal lines is 128. If the zoom ratio is set to X64, the effective horizontal lines are four (256/64, number of horizontal lines is 128 +/-2).

6-3-2. Electronic Zoom Circuit (IC1110: ELE. ZOOM)

This consists of latch circuit, coefficient circuit, horizontal expansion circuit and interpolation circuit. The 8-bit digital luma signal is supplied through pins 73 (YI7) to 66 (YI0) to the horizontal expansion circuit and 4-bit digital chroma signal is supplied through pin 53 (CI3) to 50 (CI0) to the horizontal expansion circuit in the electronic zoom circuit (IC1110: ELE. ZOOM).

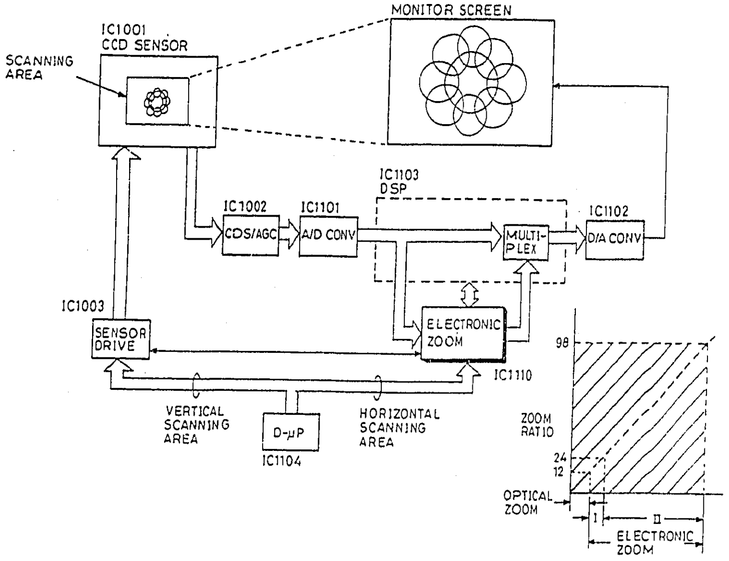

IC1001
CCD SENSOR
SCANNING
AREA
MONITOR SCREEN
IC1002
CDS/AGC
IC1101
A/D CONV
IC1103
DSP
MULTI-
PLEX
IC1102
D/A CONV
IC1003
SENSOR
DRIVE
ELECTRONIC
ZOOM
IC1110
VERTICAL
SCANNING
AREA
D-µP
IC1104
HORIZONTAL
SCANNING
AREA
98
ZOOM
RATIO
24
12
OPTICAL
ZOOM
I
II
ELECTRONIC
ZOOM

Fig. 2-21 ELectronic Zoom Operations

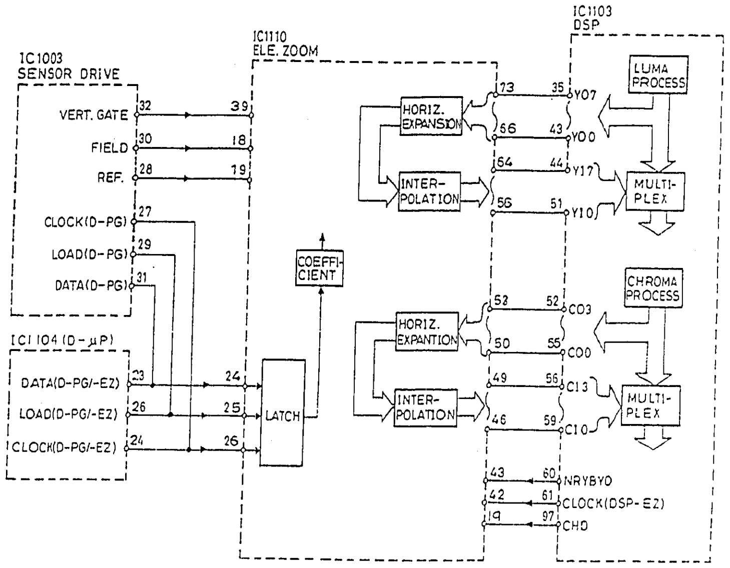

IC1003
SENSOR DRIVE
VERT. GATE
FIELD
REF.
CLOCK(D-PG)
LOAD(D-PG)
DATA(D-PG)
32
30
28
27
29
31
IC1104 (D-µP)
DATA(D-PG/-EZ)
LOAD(D-PG/-EZ)
CLOCK(D-PG/-EZ)
23
26
24
IC1110
ELE. ZOOM
39
18
19
24
25
26
LATCH
COEFFI-
CIENT
HORIZ.
EXPANSION
INTER-
POLATION
HORIZ.
EXPANTION
INTER-
POLATION
73
66
64
56
52
50
49
46
43
42
19
IC1103
DSP
35
43
44
51
52
55
56
59
60
61
97
Y07
Y00
Y17
Y10
C03
C00
C13
C10
NRYBYO
CLOCK(DSP-EZ)
CHD
LUMA
PROCESS
MULTI-
PLEX
CHROMA
PROCESS
MULTI-
PLEX

Fig. 2-22 Electronic Zoom Control Circuit

(1) Latch Circuit (LATCH) and Coefficient Circuit (COEFFICIENT)

The latch circuit communicates with IC1104 via three communications lines, DATA(D-EZ), LOAD(D-EZ) and CLOCK(D-EZ) and inputs the vertical and horizontal zoom ratios, horizontal memory start and stop data, etc. The coefficient circuit controls the horizontal expansion circuit depending on the input data and also applies the coefficient to the horizontal expansion and interpolation circuits.

(2) Horizontal Expansion Circuit (HORIZ. EXPANSION)

This consists of two line memories and expands the signal. There are 512 picture elements in the horizontal direction and the number of center picture is 256. If the zoom ratio is set to X64, the effective picture elements are eight (512/64, number of picture elements is 256 +/-4).

(3) Interpolation Circuit (INTERPOLATION)
This calculates an interpolation coefficient using the vertical and horizontal zoom ratios and interpolates the input signal. The output signal is supplied to the multiplexer (MULTIPLEX) in IC1103.

SYSTEM CONTROL

1. GENERAL (Fig. 3-1)

The system control circuit is responsible for coordinating the timing of operations within the camcorder. Among these operations are those of the cylinder, capstan and loading motors, and record/playback switching of the circuits. Two microprocessors (IC901: S-µP(system control microprocessor), IC1104: D-µP(digital camera signal control microprocessor) are provided in the system control and camera processing circuits to input the operator's commands and to control the mechanism and VTR/camera circuits.

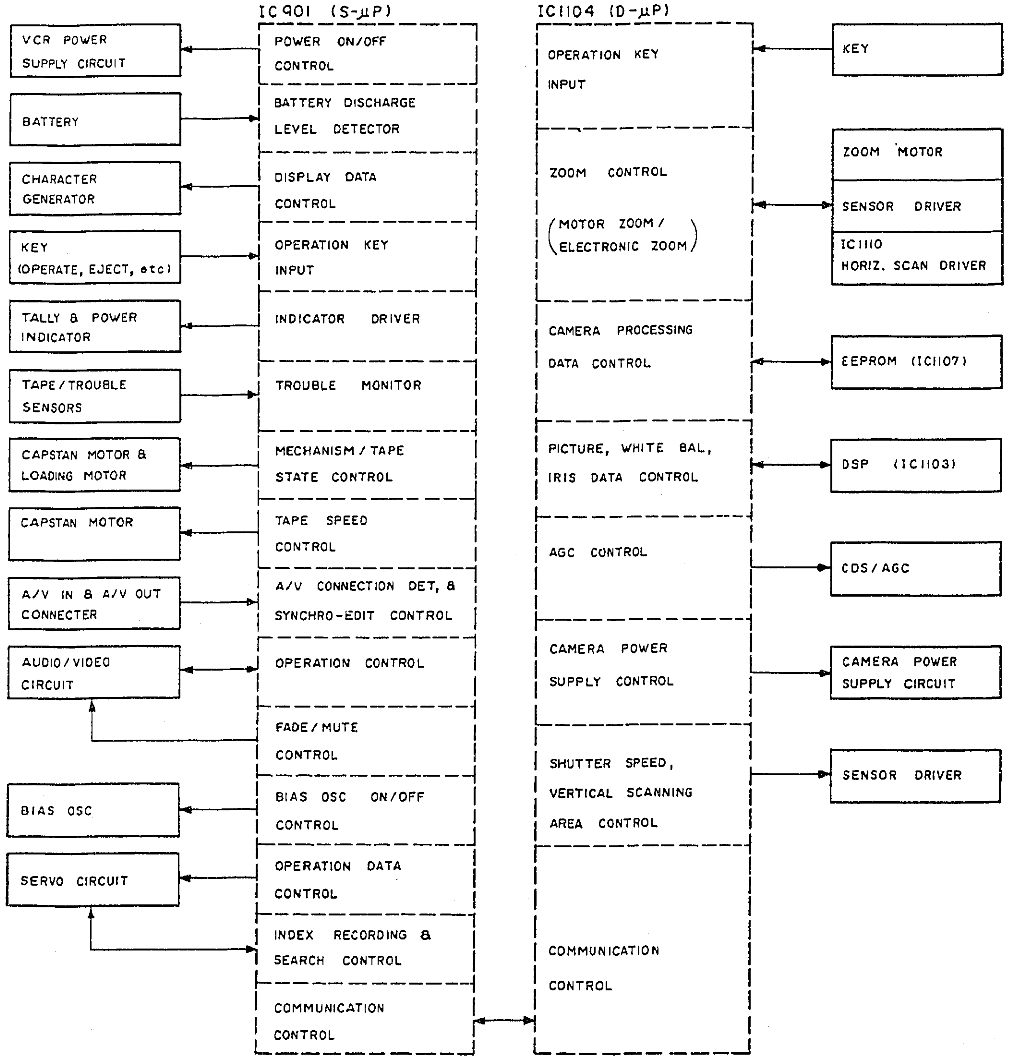
S-µP (IC901)
(1) Controls the switching regulator in the VCR block to turn the camcorder on and off.
(2) Detects the battery discharge level to display it in the EVF.
(3) Communicates with IC1104.
(4) Sends the character data (shutter speeds, battery discharge level, electrical zoom, blank search, low light warning, INDEX recording, interval recording, date/time, tape size, dubbing modes, operation modes, tape counter, tape remaining time, memory, etc.) to the character generator (IC903: CHARA. GEN) to display them in the EVF.
(5) Detects the operation keys on the top panel to enter the commanded mode.
(6) Controls two indicators (TALLY and POWER).
(7) Monitors the tape and trouble sensors (REEL, TAPE END, DEW, etc.) in the mechanism to protect the tape and mechanism against malfunctions.
(8) Controls the loading and capstan motors to switch the operation mode of the mechanism.
(9) Controls the tape speed and direction of the capstan motor.
(10) Detects the connection of the A/V IN connector (JK902) to control the power supply circuit in the camera block, and controls the VCR connected to the A/V OUT connector (JK201).
(11) Controls the audio and video circuits.
(12) Inhibits the audio and video signal outputs.
(13) Controls the bias oscillators during recording and dubbing.
(14) Sends the operation data to the servo circuit (IC601: SERVO).
(15) Controls recording/serarch of the INDEX signal.

D-µP (IC1104)
(1) Detects the operation key on the side panel.
(2) Controls the zoom motor, image sensor driver and horizontal scanning driver (IC1110) for electrical zoom when the WIDE(W) or TELE(T) button is pressed.
(3) Loads the camera processing data (WHITE BAL., PICTURE, IRIS, etc.) into digital processing circuit (DSP: IC1103) when the power is turnd on. The camera processing data is preset in an EEPROM (IC1107) in the adjustment mode.
(4) Loads the gain control data to CDS/AGC(IC1002) to set the gain of the AGC circuit.
(5) Controls the DC-DC converter in the camera block to supply the camera power supplies to the camera processing circuit in the camera mode.
(6) Loads the shutter speed and vertical scanning area control data into the sensor driver.

2. POWER SUPPLY CIRCUIT (Fig. 3-2)

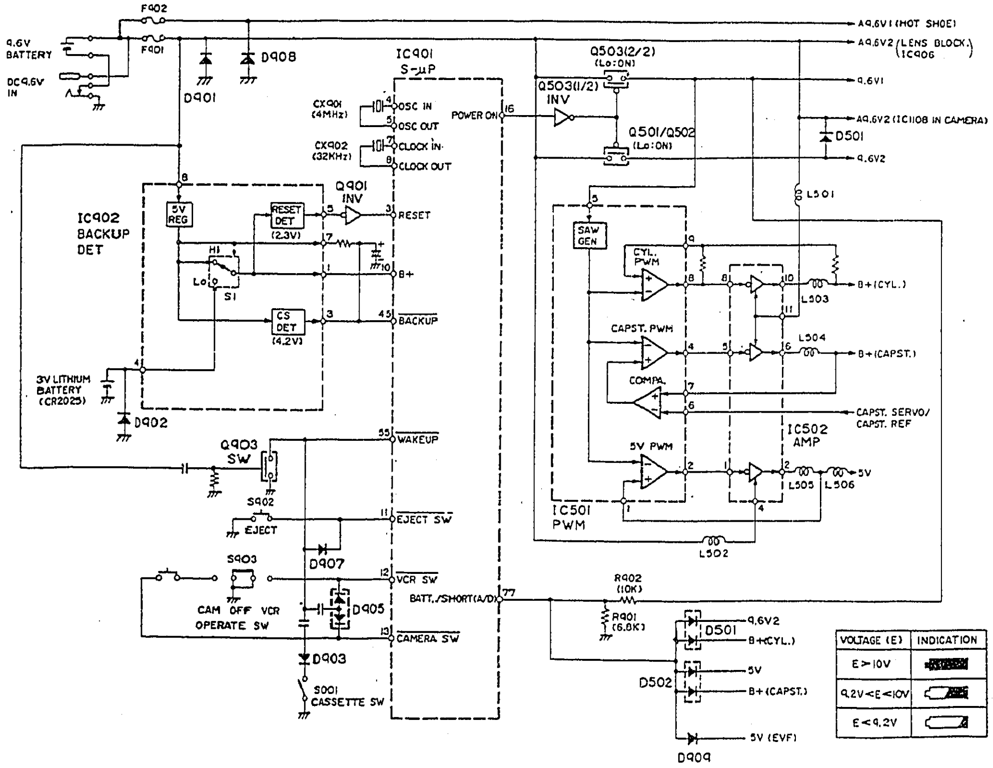
2-1. General

A9.6V from a battery or AC adapter is supplied to a hot shoe, backup detector (IC902: BACKUP DET), lens



IC901 (S-µP)
IC1104 (D-µP)
VCR POWER SUPPLY CIRCUIT
BATTERY
CHARACTER GENERATOR
KEY (OPERATE, EJECT, etc)
TALLY & POWER INDICATOR
TAPE / TROUBLE SENSORS
CAPSTAN MOTOR & LOADING MOTOR
CAPSTAN MOTOR
A/V IN & A/V OUT CONNECTER
AUDIO / VIDEO CIRCUIT
BIAS OSC
SERVO CIRCUIT
POWER ON/OFF CONTROL
BATTERY DISCHARGE LEVEL DETECTOR
DISPLAY DATA CONTROL
OPERATION KEY INPUT
INDICATOR DRIVER
TROUBLE MONITOR
MECHANISM / TAPE STATE CONTROL
TAPE SPEED CONTROL
A/V CONNECTION DET, & SYNCHRO-EDIT CONTROL
OPERATION CONTROL
FADE / MUTE CONTROL
BIAS OSC ON/OFF CONTROL
OPERATION DATA CONTROL
INDEX RECORDING & SEARCH CONTROL
COMMUNICATION CONTROL
OPERATION KEY INPUT
ZOOM CONTROL
(MOTOR ZOOM / ELECTRONIC ZOOM)
CAMERA PROCESSING DATA CONTROL
PICTURE, WHITE BAL, IRIS DATA CONTROL
AGC CONTROL
CAMERA POWER SUPPLY CONTROL
SHUTTER SPEED, VERTICAL SCANNING AREA CONTROL
COMMUNICATION CONTROL
KEY
ZOOM MOTOR
SENSOR DRIVER
IC1110 HORIZ. SCAN DRIVER
EEPROM (IC1107)
DSP (IC1103)
CDS / AGC
CAMERA POWER SUPPLY CIRCUIT
SENSOR DRIVER

Fig. 3-1 System Control



F902
F901
9.6V BATTERY
DC9.6V IN
D908
D901
IC901 S-µP
CX901 (4MHz)
CX902 (32KHz)
OSC IN
OSC OUT
CLOCK IN
CLOCK OUT
POWER ON
Q901 INV
RESET
B+
BACKUP
WAKEUP
EJECT SW
VCR SW
BATT./SHORT(A/D)
CAMERA SW
IC902 BACKUP DET
5V REG
RESET DET (2.3V)
CS DET (4.2V)
HI
LO
S1
3V LITHIUM BATTERY (CR2025)
D902
Q903 SW
S902 EJECT
S903
CAM OFF VCR OPERATE SW
D907
D905
D903
S901 CASSETTE SW
A9.6V1 (HOT SHOE)
A9.6V2 (LENS BLOCK, IC906)
9.6V1
A9.6V2 (IC1108 IN CAMERA)
9.6V2
Q503(2/2) (Lo:ON)
Q503(1/2) INV
Q501/Q502 (Lo:ON)
D501
L501
SAW GEN
CYL. PWM
CAPST. PWM
COMPA.
5V PWM
IC501 PWM
IC502 AMP
L503
L504
L505
L506
L502
B+(CYL.)
B+(CAPST.)
CAPST. SERVO/ CAPST. REF
5V
R902 (10K)
R901 (6.8K)
D501
D502
9.6V2
B+(CYL.)
5V
B+(CAPST.)
5V (EVF)
D909
VOLTAGE (E) | INDICATION
E > 10V | ▬
9.2V < E < 10V | ▭
E < 9.2V | ▭

Fig. 3-2 Power Supply Circuit for VCR Block

block, loading motor driver (IC906), DC-to-DC converter (IC1108) in the camera block, two switches (Q503(2/2) and Q501/Q502) and amplifier (IC502: AMP).

The 5V regulator (5V REG) in IC902 is always turned on and supplies A5V to a switch (S1), pin 1 and chip select detector (CS DET). S1 always detects the connection of a battery by monitoring the voltage supplied from the 5V regulator and always supplies A5V or A3V to IC901 to maintain data (date, time, etc.). The power supplied to IC901 is 5 volts in the power on mode and approx. 3 volts in the backup mode. Q503(2/2) and Q501/502 are controlled by IC901 and are turned on during power on.

Q503(2/2) supplies A9.6V to a pulse-width modulator (IC501: PWM). IC501 generates three PWM signals (B+(CYL.), B+((CAPST.) and 5V). The PWM signals are amplified by amplifiers in IC502, rectified and supplied to the VCR block.

The power supply for the camera block is described in the camera block.

2-2. Power Supply Operation

2-2-1. When only the 3V Battery (CR2025: Lithium) is connected

In order to reduce the power consumption of IC901 in the power off and backup modes, the frequency of the clock pulse and voltage of the power source is changed. The frequency of the clock pulse is changed from 4MHz (CX901) to 32kHz (CX902) in the power off and backup modes and the voltage of the power is changed from A5V to A3V in the backup mode. IC901 provides two frequency control inputs (BACKUP(Lo) and WAKEUP(Lo)) at pins 45 and 55. When only the 3V battery is connected, the output of the 5V regulator in IC902 becomes 0V. The chip select detector (CS DET)detects that the output of the 5V regulator is lower then 4.2V and supplies "Lo" to pin 45 of IC901 via pin 3. This causes IC901 to change the frequency of the clock pulse from 4MHz to 32kHz.

The power supplied to pin 10 of IC901 is controlled by a switch (S1) in IC902. S1 is controlled by the output of the 5V regulator and supplies A5V or A3V to IC901. In this case, the output of the 5V regulator is 0V, and the switch is set to "Lo". Therefore, the A3V is supplied to IC901.

Reset Operation

A reset detector (RESET DET) in IC902 outputs a reset pulse ("Lo") to pin 5 when the power becomes 2.3V or more. This reset pulse is supplied through an inverter (Q901: INV) to pin 3 (RESET) of IC901 and initialize IC901.

2-2-2. When DC9.6V (Battery or AC Adapter) is connected

When the 9.6V battery or AC adapter is connected, A9.6V is supplied to the 5V regulator in IC902 and this voltage is regulated down to A5V. This A5V is supplied through a switch and pin 1 to pin 10 of IC901.

2-2-3. When EJECT or CAMERA/VCR Switch is set

When the EJECT switch (S902) is pressed or when the OPERATE switch (S903) is set to "VCR" or "CAM", the switch input at pin 11 (EJECT SW(Lo)), 12 (VCR SW(Lo)) or 13 (CAMERA SW(Lo)) and pin 55 (WAKEUP(Lo)) becomes "Lo". The input at pin 55 instructs IC901 to change the frequency of the main clock pulse from 32kHz to 4MHz. IC901 then detects the input at pins 11, 12 or 13, turns the camcorder on and sets the POWER ON signal at pin 16 to "Hi". The POWER ON signal is inverted by an inverter (Q503(1/2): INV) and is supplied to Q503(2/2) and Q501/Q502 to supply 9.6V to IC501 in the switching regulator. The switching regulator generates three power supplies (B+(CYL.), B+(CAPST.) and 5V) for the system control, servo, luma/chroma and audio circuits. When the OPERATE switch is set to "CAM" in the power on mode, IC901 transfers the the camera on data to the digital camera signal control microprocessor (D-μP) in the camera block, and the DC-to-DC converter in the camera block will be activated.

When the A9.6V is supplied or cassette switch (S001) is pressed, pin 55 (WAKEUP(Lo)) also becomes "Lo", and the frequency of the clock pulse is changed from 32kHz to 4MHz.

2-3. Switching Regulator

When the camcorder is turned on, 9.6V is supplied to IC501 from Q503(2/2) to generate three power supplies (B+(CYL.), B+(CAPST.) and 5V) for the cylinder driver, capstan driver and VCR block. Each of the switching regulators compare the feedback voltage with an internal reference voltages to determine the pulsewidth of the PWM signal. The PWM signal outputs of IC501 are amplified by IC502.

2-3-1. B+(CYL.) Power

This is a power supply of the cylinder motor driver (IC602).

2-3-2. B+(CAPST.) Power

This drives the capstan motor and the output voltage is controlled by the CAPST.SERVO/CAPST.REF signal. The CAPST.SERVO signal is supplied from the capstan servo circuit to control the tape speed so it is constant during record and playback. The CAPST.REF signal is supplied from IC901 to control the take-up or supply reel disk speed during fast forward, rewind, loading and unloading. (Refer to "7. *CAPSTAN MOTOR CONTROL CIRCUIT*")

2-3-3. 5V Power

This is supplied to various circuits in the VCR block and EVF.

2-4. Battery Discharge Level Detection Circuit

The battery discharge detection circuit monitors the battery terminal voltage to display it in the EVF. It is in IC901 and monitors the voltage of 9.6V supplied from Q503(2/2). 9.6V is divided by a divider (R902 and R901) to 2/3 with high precision which supplies it to pin 77 (BATT./SHORT(A/D)) which is the analog-to-digital conversion input. IC901 detects the voltage and converts it into 3-step display data to display the discharge level. The discharge level is displayed by three graphics. When the battery is discharged and the voltage drops to approx. 9.2V, the graphic blinks to give an alarm, and when the voltage drops further to 8.7V, the camcorder is turned off to prevent a malfunction due to the overdischarge.

2-5. Power Supply Protection

In order to protect IC502 against short-circuits in five power lines (9.6V2, B+(CYL.), 5V, 5V (EVF) and B+(CAPST.)), a shorting protection is provided. The outputs of each power are supplied to pin 77 through diodes (D501, D502 and D909). If a short-circuit occurs, pin 77 becomes "Lo" causing IC901 to turn the camcorder off.

3. DATA COMMUNICATION AND CHARACTER GENERATION CIRCUITS (Fig. 3-3)

The system control microprocessor (IC901: S-μP) transfers/receives the data (function, etc.) to/from the digital camera signal control microprocessor (IC1104: D-μP) and transfers the character data to the character generator (IC903: CHARA. GEN)

3-1. Data Communication Circuit

3-1-1. Communication between IC901 and IC1104

IC901 and IC1104 communicate with each other. They are connected via four communication lines, STROBE(D-S), DATA(S-D), DATA(D-S) and CLOCK(D-S). The STROBE(D-S) line goes "Hi" immediately after IC901 completes data transfer to IC1104 and latches the data in IC1104. The DATA(S-D) is a data line to IC1104 from IC901 and the DATA(D-S) line is a data line to IC901 from IC1104. The serial data is transferred/received, synchronized with the CLOCK(S-D) pulse.

3-1-2. Communication between IC901 and IC903

IC901 transfers the data of characters to be recorded on the tape, to be displayed in the EVF or to be displayed on the monitor screen and the data instructing their position, to a charatcter generator (IC903). IC901 and IC903 are connected via three communication lines, CLOCK(S-CG), DATA(S-CG) and STROBE(S-CG). The DATA(S-CG) is a data line. The 8-bit serial data is transferred, synchronized with the CLOCK(S-CG) pulse. The STROBE(S-CG) goes "Hi" immediately after IC901 completes data transfer to IC903 and latches the data in IC903 at the leading edge.

3-2. Character Generator (IC903)

IC903 generates two character signals, DATE and INFOS. The DATE signal is date and time information to be recorded on the tape with the video signal and is supplied to an input signal selection circuit (IC205: INPUT SELECT) in the luma/chroma signal processing circuit. The INFOS signal is monitor information (shutter speed battery discharge level, electrical zoom, blank search mode, low light warning, INDEX recording mode, interval recording mode, tape size, dubbing mode, operation mode, tape counter, tape remaining time, memory, etc.) to be displayed in the EVF and on the monitor screen and is supplied to the video amplifier (IC203: VIDEO AMP). The V.SYNC(Lo) signal at pin 18 and the H.SYNC(Lo) signal at pin 19 are required to synchronize the output timing of the character signal with the incoming video signal. The V.SYNC(Lo) signal is supplied from IC203 and the H.SYNC(Lo) signal is supplied from the EVF.

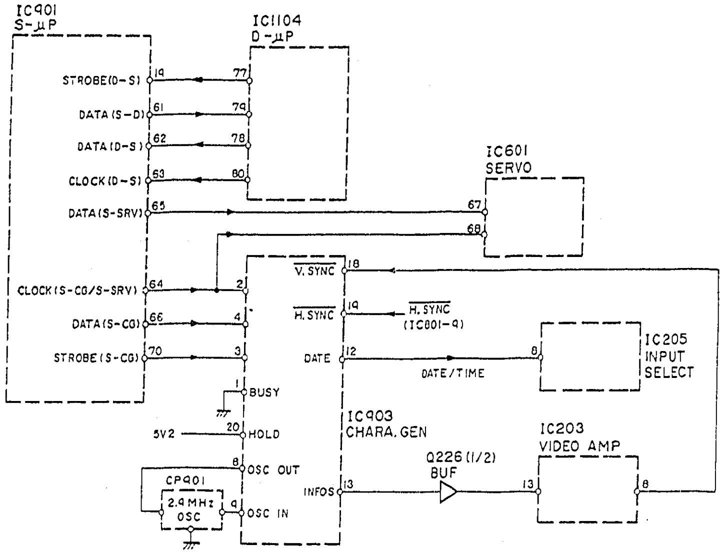


Fig. 3-3 Data Communication and Charater Generator Circuits

4. KEY INPUT/INDICATOR CONTROL CIRCUITS (Fig. 3-4)

4-1. Key Input Circuit

The operation keys are detected by D-µP and S-µP.

4-1-1. IC1104 (D-µP)
IC1104 has two analog to digital vonvertion key input pins 34 and 35 and one direct input pin17. The pin 34 inputs the voltage depending on three buttons (TITLER, NEGA/POS and ZOOM MODE) on the side panel. The pin 35 inputs the volotage depending on nine buttons (FADE, REVIEW, INDEX, DATE/TIME, RESET, MEMORY, DISPLAY, TIME LAPSE and SHUTTER) on the side panel. IC1104 inputs the voltage at pins 34 and 35, converts it into a digital input voltage and compares it with the reference voltage depending on the each key to detect the operation of pressed key.
The pin17 inputs the operation of the FULL AUTO switch (SW719).

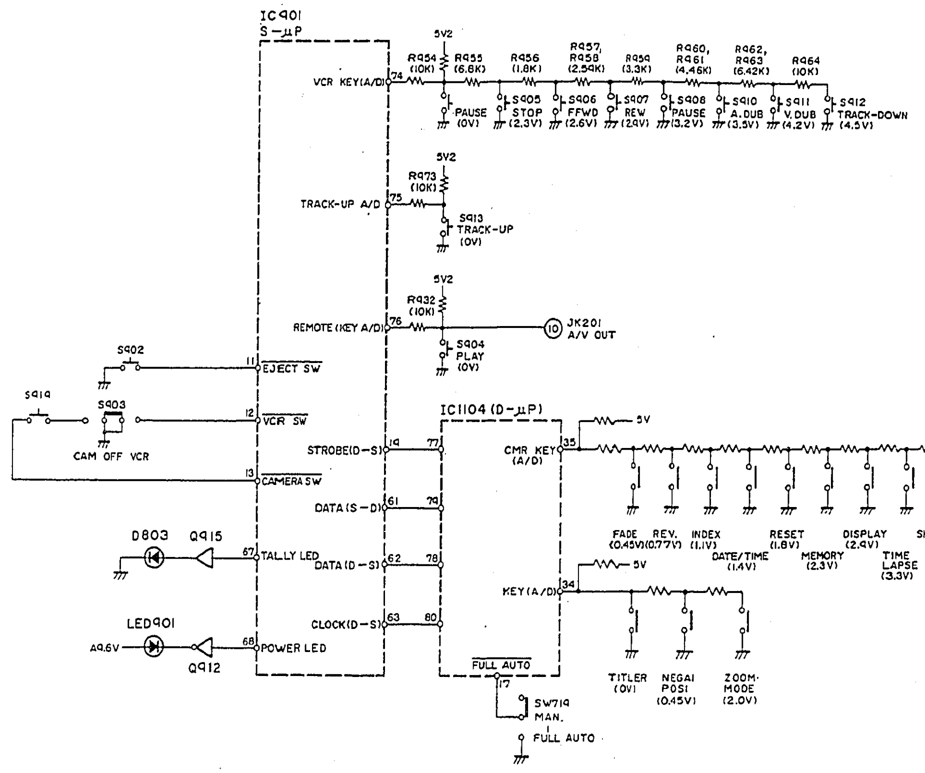
4-1-2. IC901 (S-µP)
IC901 has three analog to digital convertion key input pins 74 to 76 and three direct key input pins 11 to 13. The pin 74 inputs the voltage depending on the eight buttons (PAUSE, STOP, f.fWD, REW, PAUSE, A.DUB, V.DUB and TRACK-DOWN) on the top panel. The pin 75 inputs the voltage depending on the TRACK-UP button on the top panel. The pin 76 inputs the voltage depending on the PLAY button on the top panel or each button on the instrument connected to the A/V IN connecter. The pin 11 detects the operation of the EJECT button on the top panel. The pin 12 detects the VCR position of the OPERATE switch. The pin 13 detects the CAMEAR position of the OPERATE switch.

4-2. Indicator Control Circuit

IC901 provides two indicator control output pins 67 and 68).

4-2-1. Pin 67 (TALLY LED)
The TALLY LED signal turns the LED (D803) on during recording and off during recording pause.

4-2-2. Pin 68 (POWER LED)
The POWER LED signal turns the LED (LED901) on in the power on mode and off in the power off mode.



IC901
S-µP
5V2
R954 (10K)
R955 (6.8K)
R956 (1.8K)
R957, R958 (2.59K)
R959 (3.3K)
R960, R961 (4.46K)
R962, R963 (6.42K)
R964 (10K)
VCR KEY(A/D)
74
PAUSE (0V)
S905 STOP (2.3V)
S906 FFWD (2.6V)
S907 REW (2.9V)
S908 PAUSE (3.2V)
S910 A.DUB (3.5V)
S911 V.DUB (4.2V)
S912 TRACK-DOWN (4.5V)
R973 (10K)
TRACK-UP A/D
75
S913 TRACK-UP (0V)
R932 (10K)
REMOTE (KEY A/D)
76
JK201 A/V OUT
S904 PLAY (0V)
S902
11 EJECT SW
S919
S903
12 VCR SW
CAM OFF VCR
13 CAMERA SW
STROBE(D-S) 14
DATA (S-D) 61
DATA (D-S) 62
CLOCK(D-S) 63
77
79
78
80
D803
Q915
67 TALLY LED
LED901
A9.6V
Q912
68 POWER LED
IC1104 (D-µP)
CMR KEY (A/D) 35
5V
FADE (0.45V)
REV. (0.77V)
INDEX (1.1V)
DATE/TIME (1.4V)
RESET (1.8V)
MEMORY (2.3V)
DISPLAY (2.9V)
TIME LAPSE (3.3V)
SHUTTER (3.6V)
KEY (A/D) 34
TITLER (0V)
NEGAI POSI (0.45V)
ZOOM-MODE (2.0V)
FULL AUTO
17
SW719
MAN.
FULL AUTO

Fig. 3-4 Key Input and Indicator Control Circuit

5. TAPE/TROUBLE SENSORS (Fig. 3-5)

This detects abnormalities in the tape transport system, the mechanism state, type of cassette and the recorded condition, and protects the tape, mechanism and recorded contents from abnormal operations and malfunctions.

5-1. Supply and Take-up Reel Sensors (Q001/Q002: SUPPLY/TAKE-UP REEL SENSOR)

The supply and take-up phototransistors, Q001 and Q002, receives the light reflected by eight reflective plates attached at equal intervals to the bottom of the reel disk, and detects the reflection frequency to judge the speed of rotation of the reel disk. The outputs of the reel sensors are supplied to pins 79 (S.REEL) and 80 (T.REEL). IC901 (S-µP) counts the pulses to detect the amount of tape transported, calculates the tape remaining time and detects any abnormal reel disk speed (reel lock). When the reel pulse is not supplied for approx. 2.1 seconds in the fast forward, rewind and search modes and approx. 2.5 seconds in the record, play and dubbing modes, the mechanism state enters the L.STOP mode.

5-2. Supply and Take-up End Sensors (Q003/Q004: SUPPLY/TAKE-UP END SENSORS)

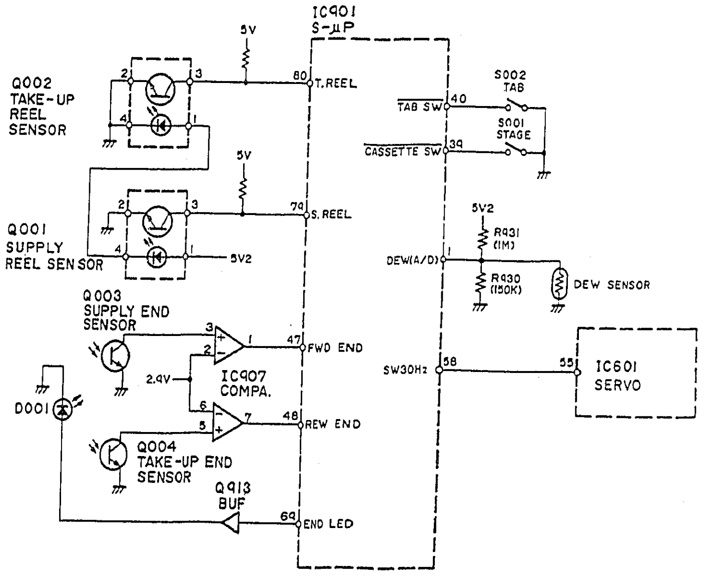
The supply and take-up tape ends are detected when two phototransistors, Q003 and Q004, receive light emitted by LED (D001) through the leader (transparent tape) at the end of the tape. D001 is driven by the pulse at pin 69 (END LED) of IC901 to prevent erroneous detection due to external light.
The outputs of Q003 and Q004 are shaped by comparators (IC907: COMPA.) and supplied to pins 47 (FWD END) and 48 (REW END) of IC901. IC901 monitors the inputs, synchronized with the light emission of D001, to detect the tape end.
When the tape end is detected by Q003 in the fast forward or dubbing mode, the camcorder enters the loading stop mode, when in the play or forward search mode, the camcorder enters the rewind mode (automatic rewind) and when in the record, edit play or forward edit mode, the camcorder enters the record pause mode.
When the tape end is detected by Q004 in the rewind mode, the camcorder enters the loading stop mode, when in the reverse search mode, the camcorder enters the play mode and when in the forward edit mode, the camcorder enters the record pause mode. When the tape end is detected by both Q003 and Q004, the camcorder determines that there is no cassette tape, and the camcorder enters the loading stop mode.

5-3. Cylinder Lock (Pin 58: SW30Hz)

IC901 receives the head switching signal (SW30Hz) generated by a servo circuit (IC601: SERVO) and monitors the frequency of the SW30Hz to detect the rotation of the cylinder motor. When the frequency of the SW30Hz signal becomes approx. 10Hz, the cylinder lock is detected and the mechanism state enters the FULL LOCK mode.

5-4. Dew Sensor (Pin 1: DEW(A/D))

A dew sensor is provided to protect the tape against malfunctions caused by dew (condensation) on the cylinder. The dew sensor detects the dew and inhibits key inputs except the POWER and EJECT inputs. The characteristics of the dew sensor are such that its impedance is several kiloohms when the relative humidity is 60% and



IC901
S-µP
5V
Q002 TAKE-UP REEL SENSOR
80 T.REEL
Q001 SUPPLY REEL SENSOR
79 S.REEL
5V2
Q003 SUPPLY END SENSOR
47 FWD END
2.9V
IC907 COMPA.
48 REW END
D001
Q004 TAKE-UP END SENSOR
Q913 BUF
69 END LED
S002 TAB
S001 STAGE
40 TAB SW
39 CASSETTE SW
5V2
R931 (1M)
1 DEW(A/D)
R930 (150K)
DEW SENSOR
58 SW30Hz
55
IC601 SERVO

Fig. 3-5 Tape and Trouble Sensors

several hundred kiloohoms when it is 80%. The voltage divided by R931 (1M) and R930 (150k) which is connected in parallel with the dew sensor is supplied to pin 1 of IC901. When the humidity increases and the voltage at pin 1 reaches 0.66V, IC901 sets the camcorder to the dew alarm mode. When the camcorder enters the dew alarm mode, the mechanism state enters the FULL LOCK mode and the power indicator flashes. When the humidity decreases and the voltage at pin 1 of IC901 is drops, the dew alarm timer in IC901 operates for 30 minutes to enter the dew alarm mode.

5-5. Cassette Switch (S001)

Pin 39 (CASSETTE SW(Lo)) detects the opening and closing of the cassette holder. When the cassette holder is closed, pin 39 goes "Lo".

5-6. Safety Tab Switch (S002)

Pin 40 (TAB SW(Lo)) detects the presence or absence of the safety tab on the cassette. When no safety tab is detected, it goes "Hi", and the mechanism state enters the FULL LOCK mode.

6. MECHANISM STATE CONTROL CIRCUIT (Fig. 3-6)

IC901 (S-μP) controls the operation mode of the mechanism via the loading motor. IC901 supplies the loading motor control outputs at pins 71 (LOAD) and 72 (UNLOAD) to a loading motor driver (IC906: MOTOR DRIVE) to drive the loading motor until the commanded mode matches the operation mode of the mechanism. The motor speed is determined by the voltage at pin 5 of IC906 and is determined by the Zener diode (ZD901). The diode (D904) turns off in modes other than loading and unloading to reduce the power consumption of ZD901.

The mechanism state switch detects eleven mechanism state (EJECT, SUB LOCK, FULL LOCK, FF/REW, BRAKE, L.STOP, PLAY/REC, F.SLOW, R.SLOW, REVIEW and CLEANING) of the mechanism and the 4-bit mechanism state data is supplied to pin 38 (M STATE 0), pin 37 (M STATE 1), pin36 (M STATE 2) and pin35 (M STATE 3).

Table 3-1 Mechanism state input code

Mechanism State	Input Code M. STATE (Pin No)				Operation mode
	0(38)	1(37)	2(36)	3(35)	
1. EJECT	Hi	Lo	Hi	Hi	Eject
2. SUB LOCK	Hi	Hi	Lo	Lo	
3. FULL LOCK	Hi	Lo	Lo	Lo	Dew Standby
4. FF/REW	Lo	Hi	Hi	Lo	FF/REW
5. BRAKE	Lo	Lo	Hi	Hi	
6. L.STOP	Lo	Lo	Lo	Lo	Rec Lock
7. PLAY/REC	Lo	Lo	Lo	Hi	Rec, Play
8. F.SLOW	Lo	Lo	Hi	Lo	Fwd slow
9. R.SLOW	Lo	Hi	Lo	Lo	Rev slow
10. REVIEW	Lo	Hi	Lo	Hi	Rev search
11. CLEANING	Lo	Hi	Hi	Hi	Cleaning

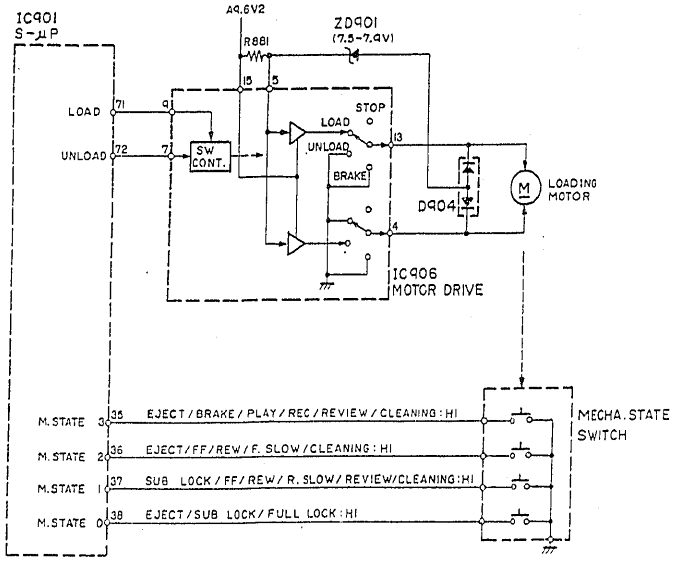

IC901
S-μP
LOAD
UNLOAD
71
72
A9.6V2
R881
ZD901
(7.5-7.9V)
15
5
9
7
SW CONT.
STOP
LOAD
UNLOAD
BRAKE
13
4
D904
LOADING MOTOR
M
IC906
MOTOR DRIVE
M.STATE 3
M.STATE 2
M.STATE 1
M.STATE 0
35
36
37
38
EJECT / BRAKE / PLAY / REC / REVIEW / CLEANING : HI
EJECT / FF / REW / F. SLOW / CLEANING : HI
SUB LOCK / FF / REW / R. SLOW / REVIEW / CLEANING : HI
EJECT / SUB LOCK / FULL LOCK : HI
MECHA. STATE SWITCH

Fig. 3-6 Mechanism State Control Circuit

7. CAPSTAN MOTOR CONTROL CIRCUIT (Fig. 3-7)

The capstan motor is responsible for controlling tape loading and unloading when a cassette is inserted or the EJECT button is pressed and tape speed during modes other than the stop and pause modes. In order to dertermine the motor driving period in the tape loading and tape unloading modes, the loading end and unloading end sensing mechanism state switchis provided. This sensor is a rotary switches, has two positions and their outputs are supplied to pin 27(T. STATE 0) and 25 (T STATE 1) of IC901.

Table 3-2 Tape loading/unloading Input code

Mechanism state	Input Code T. STATE(Pin No)	
	0(27)	1(28)
EJECT/SUB LOCK/ FULL LOCK	Hi	Lo
FF/REW/BRAKE/L.STOP/ PLAY/REC/F.SLOW/R.SLOW/ REVIEW/CLEANING	Lo	Hi

7-1. Capstan Motor Driver (IC1C: CAPSTAN MOTOR DRIVE)

IC1C has three inputs pins 2, 8 and 7.

Pin 2 (B+(CAPST.))
This is the power supply input of the capstan motor drive coils and is allso used as the speed control input. The speed control voltage is supplied through the switching regulator (IC501, IC502) from the capstan servo circuit in the record and play modes and IC901 (S-μP) in the loading, unloading, fast forward and rewind modes.

Pin 8 (BRAKE)
This is a stop control input and is "Hi" in the stop and still modes and "Lo" in the record, play, fast forward, rewind, loading and unloading modes.

Pin 7 (REVERSE)
This is a reverse control input and is "Lo" in the record, play, fast forward, forward search and loading modes and "Hi" in the rewind, reverse search and unloading modse.

IC901 (S-μP)
IC901 provides four capstan control signals at pins 53, (CAPST REF), 52(CApst SW), 30 (CAPST.BRAKE) and 29 (CAPST.REV). The CAPST.BRAKE signal at pin 30 and CAPST.REV signal at pin 29 are directly supplied to IC1C.

CAPST.REF signal (Pin 53)
This is the PWM signal whose pulse-width depends on the operation mode and is generated in the loading, unloading, fast forward, rewind and search modes. The CAPST.REF signal is lowpass filtered, amplified and then supplied to pin 2 of IC1C via switching regulator (IC501, IC502).

CAPST.SW Signal (Pin 52)
This is a selection signal for the speed control voltage to IC1C and is set to "Hi" in the loading, unloading, fast forward, rewind and search modes and "Lo" in the record, play, stop and pause modes.
When the CAPST.SW signal goes "Hi", two switches, Q505(1/2) and Q505 (2/2), turn on causing a switch (Q507) to turn off. By turning Q505(2/2) on, the CAPST.SERVO signal generated at pin 30 of IC601 is disabled . The lowpass filtered and amplified CAPST.REF signal is then supplied to the switching regulator instead of the CAPST.SERVO signal by turning Q507 off. When the CAPST.SW signal goes "Lo", Q505(1/2) and Q505(2/2) turn off, causing to turn Q507 on. By turning Q507 on, the CAPST.REF signal is disabled. The CAPST.SERVO signal is then supplied to the switching regulator by turning Q505(2/2) off.

8. INTERVAL RECORDING CONTROL

The interval recording function permits intermittent recording by repeating recording and record pause at

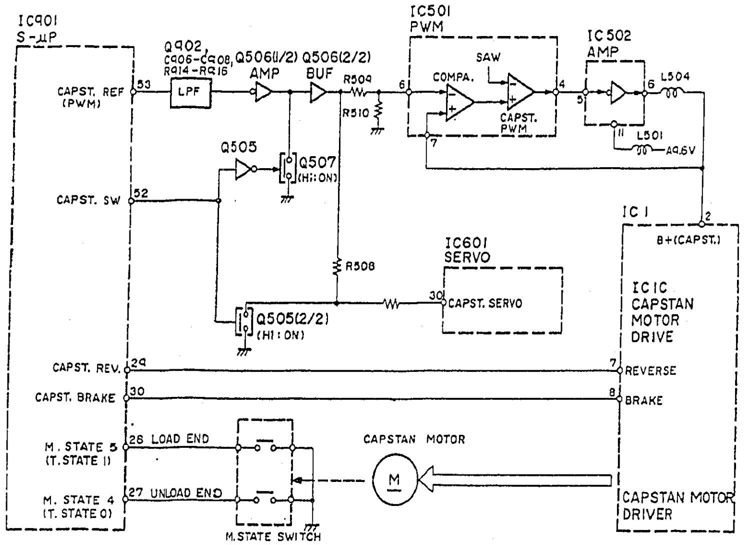

IC901
S-μP
CAPST. REF (PWM)
53
Q902, C906-C908, R914-R916
LPF
Q506(1/2) AMP
Q506(2/2) BUF
R509
R510
IC501
PWM
COMPA.
SAW
CAPST. PWM
6
4
7
IC502
AMP
5
6
11
L504
L501
A9.6V
Q505
Q507 (Hi:ON)
CAPST. SW
52
R508
IC601
SERVO
30
CAPST. SERVO
Q505(2/2) (HI : ON)
IC1
2
B+(CAPST.)
IC1C
CAPSTAN
MOTOR
DRIVE
CAPST. REV.
29
7
REVERSE
CAPST. BRAKE
30
8
BRAKE
M. STATE 5 (T. STATE 1)
26 LOAD END
M. STATE 4 (T. STATE 0)
27 UNLOAD END
M.STATE SWITCH
CAPSTAN MOTOR
M
CAPSTAN MOTOR DRIVER

Fig. 3-7 Capstan Motor Control Circuit

the interval speed or optional interval speed. Two interval recording functions are provided.

8-1. Automatic Interval Recording

This is effective for monitoring, surveillance, etc. The recording time is set to 1 second. The record pause time (interval time) is displayed in the EVF and is selected from four times (0.5, 1, 2 or 5 minutes) by pressing the TIME LAPSE/SELF TIMER switch in the record pause mode. The interval time is displayed as "INTERVAL 0:00" in the EVF and decremented every second. The cylinder motor stops for the interval period and starts when the remaining interval time reaches 5 seconds ("0.05" is displayed). The recording is restarted when the interval time reaches 0 ("0.00" is displayed).

8-2. One-Shot Recording (Manual Interval Recording)

This is effective for shooting animated sequences, etc. The recording is set to approx. 10 frames and interval time can be set to any required time by pressing the record start/stop switch in the record pause mode. The maximum interval time is within 5 minutes. When the manual interval recording mode is set, "INTERVAL MAN." is displayed in the EVF. Interval recording starts by pressing the record start/stop switch after the interval time is set.

9. EDIT (ASSEMBLE) CONTROL

This camcorder uses a flying erase head and controls the section overlap-recorded over the previously recorded video track so that it is minimized to reduce rainbow noise. When the PAUSE switch is pressed during recording, the following operations are performed.

(1) The CAPST.FG pulse counter in IC901 is reset and the LOAD and MUTE signals at pins 24 and 17 are set to "Hi" and the OSC ON signal at pin 15 is set to "Lo". The LOAD signal is supplied to the servo and luma/chroma circuits to stop recording the CTL and video signals. The MUTE signal is supplied to the audio circuit to stop recording the audio signal. The OSC ON signal is supplied to the audio circuit to stop generating the audio bias signal.
(2) IC901 sets the CAPST.SW and CAPST.REV signals at pins 52 and 29 to "Hi" and the CAPST.BRAKE signal at pin 30 to "Lo" for approx. 10ms to apply a brake to the capstan motor.
(3) IC901 sets the CAPST.SW and CAPST.REV signals to "Lo" and the CAPST.BRAKE signal to "Hi" for approx. 300 ms to apply a brake to the capstan motor.
(4) IC901 sets the CAPST.BRAKE signal to "Lo" and CAPST.REV signal to "Hi" for approx. 1.5 seconds to reverse the tape counting the CAPST.FG pulses supplied to pin 56.
(5) When the CAPST.FG pulse counter reaches 3,120, the CAPST.SW is set to "Hi" and the CAPST.REV and CAPST.BRAKE signals are set to "Lo" for approx. 10ms to apply a brake to the capstan motor.
(6) IC901 sets the CAPST.BRAKE signal to "Hi" and the CAPST.SW and CAPST.REV signals to "Lo" for approx. 300ms to apply a brake to the capstan motor.
(7) The CAPST.FG pulse counter is reset, the CAPST.REV, CAPST.BRAKE and CAPST.SW signals are set to "Lo", and the tape runs forward until the CAPST.FG pulse counter reaches 216 to correct the back tension of the tape.
(8) IC901 sets the CAPST.BRAKE signal to "Hi" and the CAPST.SW and CAPST.REV signals to "Lo" to stop the capstan motor until the record pause mode is released.

When the record pause mode is released, the following operations are performed.

(1) The CAPST.FG pulse counter is reset and the CAPST.BRAKE, CAPST.SW and CAPST.REV signals are set to "Lo" to forward the tape.

(2) IC901 sends the assemble data to IC601 via a data communication line to change the reference and feedback signals for cylinder and capstan phase control. The CAPST.SW, CAPST.BRAKE and CAPST.REV signals are set to "Lo" to start the capstan motor. The capstan speed is controlled by the CAPST.SERVO signal generated by IC601. The cylinder and capstan motors rotate synchronized with the incoming V.SYNC signal.

(3) When the CAPST.FG pulse counter reaches 2,256, IC901 starts monitoring the edge of the SW30Hz signal supplied to pin 58.
(4) When the level of the SW30Hz signal is changed from "Hi" to "Lo", the LOAD and MUTE signals are set to "Lo" and the OSC ON signal is set to "Hi" to restart recording. The FE ON signal at pin 23 is also set to "Hi" for 5 seconds.

If 5 minutes have elapsed after record pause mode is instructed, the mechanism enters the loading stop mode, the pressure roller is released and the cylinder motor is stopped.

10. PROGRAMMABLE SYNCHRO. EDIT CONTROL

IC901 has a CTL (or linear time) counter which makes it possible for operations (record and record pause) of the VCR connected to the A/V OUT connector to be controlled by an optional remote controller. The CTL counter counts up the CTL pulses during the play, forward/reverse search, slow, fast forward and rewind modes and the reading of the CTL counter is compared with the reading of the start and end points of the program to control the SYNCHRO. EDIT signal to be supplied to the VCR.
This function performs editing of a maximum of six programs by the VCR. The SYNCHRO. EDIT signal generated at pin 22 and inverted by an inverter (Q908) goes "Lo" in the record mode and "Hi" in the record pause mode.

11. BLANK SEARCH CONTROL

IC901 searches a blank section of the recorded tape using the CTL pulse counter. When the PLAY and F.FWD switches are pressed simultaneously and held for more than 1 second in the record pause, edit play or edit forward search mode, IC901 enters the blank search mode and the "B.SEARCH" is displayed in the EVF.

(1) IC901 forwards the tape and detects the blank section of the recorded tape by counting the CTL pulses.

(2) When the blank portion which is not recorded with CTL signals for 3 minutes is detected, IC901 determines that the blank section is detected and changes the tape feed direction to determine bigining of the recording

(3) When the number of the CTL pulse counter reaches 60 (2 seconds), IC901 detects the recorded section and enters the record pause mode.
If the tape has ended when the camcorder has entered the blank search mode, IC901 reverses the tape, detects the recorded section and enters the record pause mode after detection is completed. If IC901 cannot detect a blank section in the forward direction, IC901 enters the record pause mode at tape end. If IC901 cannot detect a recorded section in the reverse direction, IC901 enters the record pause at tape start.

12. HEAD CLEANING CONTROL

The head cleaning will be performed as follows.

(1) When the tape loading is completed after inserting a tape.

(2) When the power is turned on with a tape loaded completely.

(3) When the cylinder motor is stopped after 5 minutes has elapsed in the record pause mode.

PIN FUNCTIONS

S-µP: IC901 (SYSTEM CONTROL MICROPROCESSOR)

Pin No.	I/O	Active Level	Abbreviation	Function
1	I	0V - 5V	DEW(A/D)	Detects condensation and inhibits key operation other than POWER and EJECT in the dew alarm mode. When the condensation is removed from the dew sensor, the dew alarm timer operates to enter the dew alarm mode for 30 minutes.
2	-	-	GND(A)	Grounded.
3	I	Hi	RESET	Initializes the µP.
4	I	(Pulse)	OSC IN	Generates 4MHz main clock pulses.
5	O	(Pulse)	OSC OUT	
6	-	-	GND	Grounded.
7	I	(Pulse)	CLOCK IN	Generates 32kHz clock pulses to maintain the date and clock .
8	O	(Pulse)	CLOCK OUT	
9	I	Lo	TEST	Connected to 5V/3V.
10	-	-	B+	
11	I	Lo	EJECT SW	Detects the operation of the EJECT switch to eject the cassette in the power on or off mode.
12	I	Lo	VCR SW	Detects the VCR position of the OPERATE switch to control the switching regulator in the VCR block.
13	I	Lo	CAMERA SW	Detects the CAMERA position of the OPERATE switch to control the DC-DC converter in the camera block.
14	-	-	-	Not used.
15	O	Hi	OSC ON	Turns the bias oscillator to supply the bias signal to the audio R/P and audio erase heads during recording.
16	O	Hi	POWER ON	Turns the switching regulator in the VCR block on.
17	O	Hi	MUTE	Mutes the audio signal.
18	O	Hi	REC MUTE	Mutes the audio recording signal during modes other than play and V.DUB.

Pin No	I/O	Active	Abbreviation	Function
19 61 62 63	O O I O	(Pulse) (Pulse) (Pulse) (Pulse)	STROBE(S-D) DATA(S-D) DATA(D-S) CLOCK(S-D)	Transfers the operation data to/from the digital camera signal control microprocessor (D-μP) in the camera block.
20	O	Hi	FADE MUTE	Not used.
21	O	Hi	FADE	Instructs fading out at the leading edge and fading in at the trailing edge.
22	O	Hi/Lo	SYNCHRO. EDIT	Controls the operation (record and record pause) of the VCR connected to the A/V OUTPUT connector. (Hi: Record, Lo: Record pause)
23	O	Hi	FE ON	Turns the bias oscillator on to supply the bias signal to flying erase head.
24 25	O O	Hi Hi	LOAD TRICK PLAY	Stops the recording of the CTL pulse.
26	I	Hi	AV IN	Detects the connection of the instrument connected to the A/V IN connector to automatically select the video and audio signals supplied from the A/V IN connector.
27 28	I I	Hi/Lo Hi/Lo	T .STATE 0 (M. STATE 4) T .STATE 1 (M. STATE 5)	Detects the tape loading/unloading state to control the capstan motor.
35 36 37 38	I I I I	Hi/Lo Hi/Lo Hi/Lo Hi/Lo	M.STATE3 M.STATE 2 M.STATE1 M.STATE0	Detects the mechanism state to control the loading motor.
29	O	Hi	CAPST.REV	Reverses the tape in the rewind and reverse search modes.
30	O	Hi	CAPST.BRAKE	Stops the capstan motor in the stop and pause modes.
31	-	-	-	Not used.
32	O	H	REC/V.DUB	Sets the video circuit to record.
33	O	Hi	A.DUB	Stops the operation of the for bias oscillator flying erase head during audio dubbing and A/V dubbing modes.
34	-	-	-	Not used.
39	I	Lo	CASSETTE SW	Detects the up and down positions of the cassette holder.
40	I	Lo	TAB SW	Detects whether the tab is present or not to avoid accidental erasing.
41 42	I I	Lo Hi	SELF TIMER SEARCH LOCK	Selects the function of the unit.
43 44	- -	- -	- -	Not used.
45	I	Lo	BACKUP	Detects whether the 9.6V battery or AC adapter is disconnected or not and switches the clock pulse to 32kHz from 4MHz to reduce the power consumption of μP.
46	O	Hi	MONITOR CUT	Mutes the video signal during loading.
47	I	Hi	REW END	Detects the tape end during rewind and reverse search modes.
48	I	Hi	FWD END	Detects the tape end during fast forward and forward search modes.
49	-	-	-	Not used.
50	I/O	(Pulse)	VISS/DUTY	Sets the duty ratio (30% or 60%) of the CTL pulse in the record mode and detects it in the play mode.
51	O	Lo	PB/A.DUB	Sets the audio circuit to play
52	O	Hi	CAPST.SW	Disables the output of the capstan servo in the fast forward and rewind modes.
53	O	PWM	CAPST.REF	Controls the tape speed in modes other than record and play modes.
54	O	Lo	PB	Generates the PB5V to supply it to the video circuit.
55	I	Lo	WAKEUP(Lo)	Changes the clock pulse to 4MHz from 32kHz when the EJECT switch is pressed or when the OPERATE switch is set to VCR or CAMERA position.
				OPERATE switch is set to on or when the cassette holder is closed.

Pin No.	I/O	Active Level	Abbreviation	Function
56	I	(Pulse)	CAPST.FG	Calculates the amounts of the tape rewound when the PAUSE switch is pressed.
57	I	(Pulse)	CTL	Utilized as clock pulse for linear time counter.
58	I	(Pulse)	SW30Hz	Detects the cylinder lock and determines the output timing of the bias oscillator for flying erase head.
59	I	Hi	REMOTE	Not used.
60	I	Lo	-	Not used.
64	O	(Pulse)	CLOCK(S-CG/ S-SRV)	Transfers the display data to the character generator (IC903) and servo circuit (IC601) synchronized with this clock pulse.
65	O	(Pulse)	DATA(S-SRV)	Transfers the servo operation data to IC601.
66 70	O O	(Pulse) (Pulse)	DATA(S-CG) STROBE(S-CG)	Transfers the character and address data to IC903.
67	O	Hi	TALLY LED	Lights the tally (or record) indicator during recording .
68	O	Hi	POWER LED	Lights the power indicator.
69	O	(Pulse)	END LED	Lights the end LED to detect the tape end.
71 72	O O	Hi Hi	LOAD UNLOAD	Controsl the loading motor to control the mechanism state .
73	-	-	B+(A)	Connected to the 5V line.
74 76	I I	0-5V 0-5V	VCR KEY(A/D) REMOTE KEY (A/D)	Detects the operations of the VCR key.
75	I	0-5V	TRACK-UP(A/D)	Detects the operation of the TRACKING-UP button.
77	I	0-5V	BATT./SHORT (A/D)	Detects the battery discharge levels to display it in the EVF and detects the short-circuit of five power supplies.
78	I	Hi	CLEANING	Sets the unit with the automatic head cleaning function.
79	I	(Pulse)	S.REEL	Calculates the time remaining.
80	I	(Pulse)	T. REEL	Calculates the time remaining, counts up the tape counter and detects the reel lock.

D-μP: IC1104 (DIGITAL CAMERA SIGNAL CONTROL MICROPROCESSOR)

Pin No.	I/O	Active Level	Abbreviation	Function
1	I	Hi	RESET	Initializes IC1104 (D- μP).
2 3	O I	(Pulse) (Pulse)	OSC OUT OSC IN	Generates 15MHz clock pulse.
4 7	- -	- -	- -	Not used.
8	-	-	B+	Connected to the C5V.
9	-	-	-	Not used.
10 11	I O	(Pulse) (Pulse)	- -	Not used.
12	-	-	GND	Grounded.
13 14 15	O O O	Hi Hi Hi	SHUT.1 SHUT.2 SHUT.3	Controls the shutter speed.
22	O	Hi/ PWM.	SHUT.4	Controls the shutter speed
16	O	Hi	T-160	Not used.
17	I	Lo	FULLAUTO SW	Detects the AUTO position of the FULL AUTO switch .
18	I	(Pulse)	AE TIMING	Controls the shutter speed.
19	I	(Pulse)	FV	Detects the iris data.
20 27 28	I I I	(Pulse) (Pulse) (Pulse)	AREA 2 AREA 1 AREA 3	Detects the sampling area of the picture to control the iris .

Pin No	I/O	Active Level	Abbreviation	Function
21	I	(Pulse)	HD	Determines the exposure time (shutter speed).
42	I	(Pulse)	HD	
23	O	(Pulse)	DATA(D-PG/D-EZ)	Transfers the data for IC1003 (and IC1110 (Electrical zoom)).
24	O	(Pulse)	CLOCK(D-EZ)	
25	O	(Pulse)	CLOCK(D-PG)	
26	O	(Pulse)	LOAD(D-PG/D-EZ)	
29	-	B+(A)	Connected to C5V.	
30	O	Lo	ZOOM SW	Detects maximum zoom ratio to operate the electronic zoom function.
31	O	Hi	MOVE (VERT.)	Not used.
32	O	Hi	MOVE (HORIZ.)	
33	I	0-5V	F.DET(A/D)	Detects the F value to contrl the automatic exposure.
34	I	0-5V	TITLE KEY(A/D)	Detects the operation of TITLE, NEGA/POS and ZOOM MODE buttons.
35	I	0-5V	CAMERA KEY (A/D)	Detects the operation of FADE, REVIEW, INDEX, DATE/TIME, RESET, MEMORY, DISPLAY, TIMELAPSE, and SHUTTER buttons.
36	I	0-5V	IRIS CONT.(A/D)	Detects the manual iris control level.
37	I	0-5V	WHITE BAL.(A/D)	Not used.
38	-	-	GND(A)	Grounded.
39	I	(Pulse)	DATA(D-ROM)	Transfers/receives data to/from IC1107 (EEPROM).
40	O	(Pulse)	DATA(ROM-D))	
41	O	(Pulse)	CLOCK(D-ROM)	
44	O	(Pulse)	CS(D-ROM)	
43	O	(Pulse)	KNEE	Not used.
45	O	(Pulse)	IRIS DRIVE	Drives the iris motor driver (PWM signal).
46	-	-	-	Not used.
47	-	-	B+	Connected to C5V.
48	O	Hi	COUNT CLEAR	Not used.
49	I	Lo	SECAM	Sets the internal modes.
50	I	Lo	PAL	
51	I	Hi	ELE. ZOOM	
52	O	Hi	TITLE(NEXT)	Not used.
53	O	Hi	TITLE(BEFORE)	
54	O	Hi	TITLE ON	
55	O	Hi	RESET(TITLE)	
57	O	HI	PROTECT(TITLE)	
56	-	-	GND	Grounded.
58	O	Hi	CAMERA ON	Turns the DC-DC converter in the camera block on to supply power supplies to the camera circuit.
59	-	-	-	Not used.
61	-	-	-	
62	O	(Pulse)	DATA(D-DSP)	Transfers the operation data to IC1103 (DSP).
63	O	(Pulse)	CLOCK(D-DSP)	
64	O	(Pulse)	LOAD(D-DSP)	
65	I	(Pulse)	DATA(DSP(DET)-D	Receives the automatic iris and white balance control data from IC1103 (DSP).
66		(Pulse)	CLOCK(D-DSP (DET))	Transfers state data to IC1103.
67	O	(Pulse)	LOAD(D-DSP (DET))	
68	O	(Pulse)	DATA(D-DSP (DET))	
69	O	(Pulse)	CLCOK(D-AGC)	Transfers state data to IC1002 (CDS/AGC).
70	O	(Pulse)	DATA(D-AGC)	
71	I	Lo	TELE SW(Lo)	Detects the opeartion of two zoom buttons and controls the zoom motor.
72	I	Lo	WIDE SW(Lo)	
74	O	Hi	TELE	
75	O	Hi	WIDE	

Pin No	I/O	Active Level	Abbreviation	Function
73	-	-	GND	Grounded.
76	O	Hi	AUTOFOCUS ON	Controls the automatic focus control circuit.
77	O	(Pulse)	STROBE(D-S)	Transfers and receives state data to/from IC901 (S-μP).
78	O	(Pulse)	DATA(D-S)	
79	I	(Pulse)	DATA(S-D)	
80	O	(Pulse)	CLOCK(D-S)	

MECHANISM OPERATION

1. OVERVIEW (Fig. 7-1)

The SL Mechanism has been newly developed for full-size video cassette camcorders to allow cylinder positioning from the side of the cassette, which gives overall reduction in height compared to conventional camcorders.

In the side loading method, the take-up guide roller and take-up slant pole pull the tape from the cassette and wrap it around the cylinder. A full loading method then wraps the tape around the cylinder. This is to reduce time required for switching the operation mode and to use linear counter function.

The CH1 and CH2 video heads are set 180° opposite to each other. These heads have a track width of 65 micrometers. The 118-micrometer wide flying erase head is attached so as to be delayed 120° after the CH1 video head. Flying erase head azimuth is 0° (see Fig. 7-1).

Use of a standard 62mm cylinder ensures compatibility with any future functions. A cleaning roller built-in to the cylinder exit (take-up side) cleans the head dirty at loading and unloading. A wall between the cassette housing and cylinder section prevents condensation from external air flowing directly into the cylinder section when the cassette is inserted or ejected. Upper cylinder attachment has been improved by changing from the conventional plug connector to the pressure contact system.

The SL chassis has three motors:

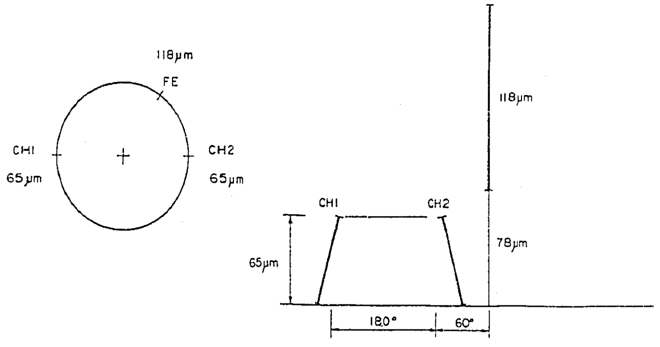


Fig. 7-1 Video Head Arrangement

(1) Capstan motor

Drives both reel disks and loads tape.

(2) Cylinder motor

Drives the cylinder.

(3) Loading motor

Used to switch the operation mode (capstan motor performs actual loading).

Output from the two mechanism state switches is read to determine which of the eleven contact modes below to enable.

(1) EJECT
(2) SUB LOCK
(3) FULL LOCK
(4) FF/REW
(5) STOP
(6) L. STOP
(7) PLAY/REC/CUE
(8) F. SLOW
(9) R. SLOW
(10) REV
(11) CLEANING

2. MAJOR COMPONENTS LOCATION OF SL CHASSIS (Fig. 7-2)

Fig. 7-2 shows the SL chassis's top surface. The description below follows tape run path to explain what the purpose of each part is and how they work.

(1) Supply reel disk
A tension band wraps around the side of the supply reel disk to control the supplied tape's tension. A reflector plate for detecting rotation is attached at the bottom to output eight sine-wave pulses in each rotation. These pulses are also used for the display of remaining tape time. A slip mechanism built into relay gear S supplies torque to the supply reel disk while slipping it when unloading the tape.
The supply reel disk's top surface, i.e., the surface in contact with the cassette reel hub, has a rubber washer that prevents the reel hub from rattling during rotation. The rubber washer prevents jitter caused by the turning of supply reel disk and reel hub sideways during normal (vertically) camcorder operation. This causes the reel disk tab and reel hub opening to rattle during reel hub rotation, and, in turn causes the reel hub to drift in the vertical direction during rotation.

(2) Tension arm
The tape wrapped around the tension arm's tension roller, and the spring at the tension arm's opposite end, balance and control tape tension. To adjust tape tension spring strength is changed. With the SL mechanism, that tension is adjusted by attaching appropriate springs. One end of the tension band is attached to the tension arm so that it can move freely. The other end of the tension band is attached to the terminal plate on the chassis. Using a flat-blade screwdriver to turn the adjustment knob on the terminal plate changes the angle at which tape wraps around the tension roller, i.e., adjusts the tension servo mechanism's gain. When adjusting tension, it is best to first adjust the angle of wrap in relation to the tension roller and then to adjust the tension itself.

(3) Supply guide pin
This is the guide roller that pulls the tape out of the cassette to prepare for loading start. The loading motor attached near the end lamp drives the supply guide pin.
When the supply guide pin turns clockwise, the take-up guide arm also turns clockwise to pull the pressure roller and the take-up guide pole out to the position of the loading guide rail and prepare for loading. During playback, the supply guide pin guides the supplied tape.

(4) Full erase (FE) head
The FE head erases in the same way as a conventional head, it uses a 70kHz liner audio recording bias current.

(5) Supply guide roller
The supply guide roller is built to adjust the height of the tape travel subsystem in the same way as a conventional guide roller. The adjustment of tape travel is made by checking that the FM waveform.

(6) Impedance roller
The impedance roller reduces jitter by absorbing fluctuations in tension and speed during tape playback. The roller's highly precise construction means that it is free of any scratches or marks. Never oil the bearing section. If the bearing is lubricated, conditions that cause jitter may occur.

1) Oil may leak out and get on the tape
2)The oil's viscosity may prevent the roller itself from turning properly at low temperatures. A brass ring is attached to the top to increase inertia.

(7) Supply slant pole
During eject, the supply slant pole is in the cassette, and as the tape load proceeds, the slant pole turns until it is set into its assingned position. The angle of the slant is fixed.

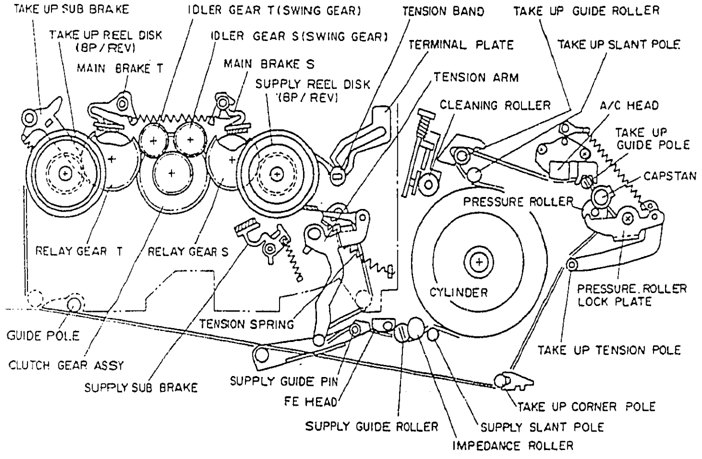


Fig. 7-2 Major Component Location

(8) Cylinder
The basic cylinder structure has not been changed from that of previous models with the exception of improvements made by changing from conventional plug connector to pressure-contact (surface pressure adherent) connection. The ground brush has been moved to the bottom to eliminate electrostatic noise. A bulge has been provided for the tape outlet side (near the 180 degrees point), but all other parts of cylinder structures are the same as previously. The upper cylinder is placed into position by inserting a pin, which projects from the lower cylinder, into a reference hole in the upper cylinder, adjust the switching point to ensure X value (compatibility).

(9) Cleaning roller
The cleaning roller comes into contact with the video head to clean it during loading and unloading.
The roller is made by overlapping special thin sheet. The dirt removed from the head is held between these sheets so that it cannot get on the head again.
The roller itself turns freely so that it does not damage the video head during cleaning.

(10) Take-up slant pole
The take-up slant pole is positioned inside the cassette during eject. As loading proceeds, the loading link drives it, and the take-up guide roller, to set them on the take-up arm stopper. The take-up slant pole is at a fixed angle. The guide roller spring (shown in Fig. 7-4) applies pressure to the catcher.

(11) Take-up guide roller
The take-up guide roller is attached to the same die-cast base as the take-up slant pole. As tape loading proceeds, the video tape is pulled out of the cassette and wrapped round the cylinder.
To wrap the tape round the cylinder, the take-up guide roller slides along the loading guide grooves and goes around the cylinder.
When tape is fully wound, the take-up guide roller is set on the take-up arm stopper. The guide roller spring applies the required pressure.

(12) A/C head
The A/C head is actually three heads:

(1) Audio erase head
(2) Audio head
(3) Control head

To erase audio signals, a 70kHz bias current used during recording of linear audio flows through the audio erase head.
The audio head records and plays back linear audio.
The control head separates vertical sync signals from video signals and records a signal that is 1/2-frequency divided to 30Hz on the control track. This control signal controls the speed during playback.

(13) Capstan motor (DD motor)
The capstan shaft is constructed so as to place the pressure roller in contact with the center section, which contains bearings to support the shaft at the top and bottom. This type of support construction allows the shaft diameter to be decreased.
It also provides a very fast shaft speed, which helps to reduce audio wow and flutter.
In addition to driving both reel disks, the capstan motor provides torque for tape loading.
The up-down movement of the R block mechanism's change gear L, turns the loading torque on and off. A CFG magnet ring attached to the capstan motor's outmost edge generates a 2160Hz CFG in the SP mode.

(14) Take-up guide pole
This pole guides tape travel near the A/C head. Its height can be adjusted.
During eject, the take-up guide pole is inside the cassette. As loading proceeds, the pole is guided by the loading groove, along with the pressure roller, to be set into the pole receptacle provided by the A/C head.

(15) Pressure roller
The one ball bearing at the center of the pressure roller eliminates the need to ensure that the pressure roller and capstan shaft are perfectly parallel. Pressure on the capstan shaft is applied by the pressure roller lock plate that presses the pressure roller's top and bottom against the capstan. The pressure roller's internal construction is the same as in conventional models.

(16) Take-up tension pole
Because the distance from the capstan to the take-up corner pole is so long, the take-up tension pole prevents tape slack. Care must be taken to ensure that the tension pole does not become magnetized through contact with the tape's magnetic surface.

(17) Take-up corner pole
In the playback mode, the take-up corner pole stands vertically to guide the tape, but in the loading and unloading modes, passing the take-up guide roller assembly and pressure roller causes the take-up corner pole to fall to the side. In all other modes, the pole is diagonal. The torque for tape drive passes from the loading ring and through the corner pole drive gear.

(18) Take-up reel disk
The take-up reel disk's top surface, i.e., the surface in contact with the cassette reel hub, has a rubber washer that prevents the reel hub from rattling during rotation.
A reflecting plate for sensing rotation is built into the reel disk bottom.
The reflecting plate generates eight sine-wave pulses for every rotation that is used to detect rotation and display the tape remaining. The reel disk contains no built in slip mechanisms.

(19) Main brakes S and T
This braking method applies contact pressure to the sides of relay gears S and T.
The brakes are applied by directionality braking. Because this method uses the difference in braking power between the bite-in and escape directions to stop the tape without any slack, it is important that the brake shoe surface friction coefficient is more than a certain value.

(20) Relay gears S and T
These relay gears transmit torque from the capstan motor to both reel disks.
Both the main S and T brakes brake the relay gear to stop tape travel.
Back tension is applied to relay gear T during loading/unloading and reverse visual search.

(21) Clutch gear assembly
The clutch gear has a built-in slip mechanism that passes tape take-up and unloading torque to both reel disks. Idler gears S and T mesh with the clutch gear, each following the clutch gear's direction of rotation to swing and transmit torque to both the take-up and supply reel disks.

(22) Idler gears S and T (swing gears)
Idler gears S and T mesh with the clutch gear assembly to swing to right or left in line with the direction of clutch gear assembly rotation and to drive both reel disks. The reason for having two idler gears, S and T, is to reduce 1) mode switching time and 2) noise in the playback picture as much as possible.

(23) Take-up sub-brake
Back tension is applied to relay gear T during loading, unloading and reverse visual search to prevent slack in the tape supplied from the take-up reel disk.
(24) Supply sub-brake
Applies weak back-tension to the supply reel disk during loading and unloading to prevent tape slack.

3. LOADING BLOCK DRIVE MECHANISM (Fig. 7-3)

Capstan motor power performs most of the loading. The loading motor prepares loading and switches the mechanism state switches.
Pressing the play switch turns the loading motor on to transmit torque through reduction gears 1 and 2 to the drive gear.
The pin on the guide pin operation arm is inserted in the cam groove on the drive gear's bottom surface to drive the gear. A drive pin is installed at the other end of the guide pin operation arm to press the supply guide pin and turn it clockwise to prepare for loading.
The mode gear meshes with the drive gear and drives mechanism state switch 1.
Mechanism state switch 2 is built into the same loading block. The loading ring assembly drives mechanism state switch 2 by means of reduction gears 3 and 4. That makes mechanism state switch 2 the decision maker for each mechanism mode. In installing this loading block, the drive gear's marking hole must be positioned over the hole drilled in the chassis. (FULL LOCK mode position).
Installation is made by matching the drive gear's alignment mark (Δ) with the mode gear's phase alignment (Δ) mark. Because the mode gear is an idler gear it is not theoretically necessary that it be in phase, but its phase is set to improve the precision of mechanism state switch 1's installation.
Reduction gear 3 alignment mark (O) and reduction gear 4's alignment mark (O) are matched when installing.
Reduction gear 4's other alignment mark (O) and mechanism state switch 2's alignment mark (Δ) are matched when installing.

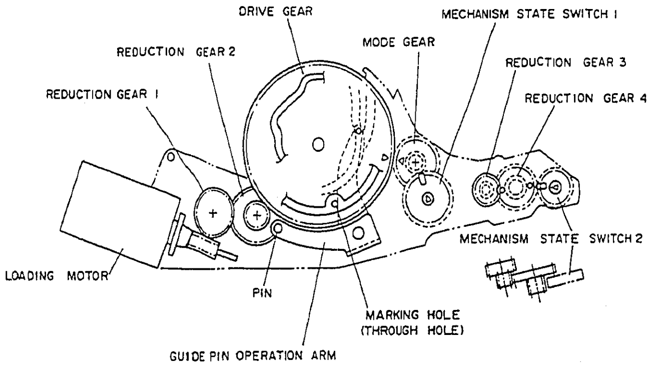

DRIVE GEAR
MECHANISM STATE SWITCH I
MODE GEAR
REDUCTION GEAR 2
REDUCTION GEAR 3
REDUCTION GEAR I
REDUCTION GEAR 4
MECHANISM STATE SWITCH 2
LOADING MOTOR
PIN
MARKING HOLE
(THROUGH HOLE)
GUIDE PIN OPERATION ARM

Fig. 7-3 Loading Block Drive Mechanism (Top View)

4. LOADING DRIVE MECHANISM (I) (Fig. 7-4)

Fig. 7-4 shows the loading drive mechanism as seen from an overhead cutaway view. When the supply guide arm turns clockwise, the pin attached to its opposite end turns the take-up guide arm counterclockwise.
A loading ring guide pin fits into the groove in the take-up guide arm so that when the arm turns counterclockwise, the pressure roller and take-up guide roller are pushed out of the loading groove to complete preparations for loading.

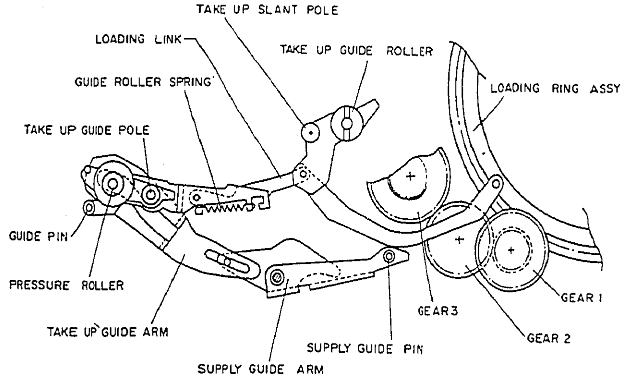

TAKE UP SLANT POLE
LOADING LINK
TAKE UP GUIDE ROLLER
GUIDE ROLLER SPRING
LOADING RING ASSY
TAKE UP GUIDE POLE
GUIDE PIN
PRESSURE ROLLER
GEAR 3
GEAR I
TAKE UP GUIDE ARM
GEAR 2
SUPPLY GUIDE PIN
SUPPLY GUIDE ARM

Fig. 7-4 Loading Drive Mechanism (1)

5. LOADING DRIVE MECHANISM (II) (Fig. 7-5)

When loading preparation is complete, torque from the capstan motor passes through loading gear 3 to the loading ring assembly.
Turning the loading ring assembly counterclockwise guides the loading link, which is attached to the assembly but is free to move, through the loading groove for the load. This guides the (1) take-up guide roller, (2) take-up slant pole, (3) pressure roller and (4) take-up guide pole in the loading guide grooves to load. When these parts pass the take-up corner pole, the corner pole drive gear, which meshes with the gear inside the loading ring assembly, drops the take-up corner pole on its side to prevent it from passing these parts.
After the pressure roller and guide pole pass the vicinity of the impedance roller, gear 1, which meshes with the inside of the loading ring assembly, sends torque to gears 2 and 3 to turn the slant pole arm and set the supply slant pole to the side of the impedance roller.
The torsion coil spring built into gear 3 applies pressure to the supply slant pole at this time. The take-up guide roller and take-up slant pole pass near the L-link lock plate, which turns the guide arm built into the loading guide groove and guides the pressure roller and take-up guide pole through separate grooves to set them in their assigned locations.
After the pressure roller contacts the capstan shaft, the pressure roller lock plate compresses the pressure roller against the capstan shaft. The L-link lock plate presses the take-up guide pole into the V-stopper.
The take-up guide roller and take-up slant pole continue to move forward and push into the arm stopper.
When loading is finished, and mechanism state switch 2, shown in Fig. 7-3, detects the loading end, change gear L, shown in Fig. 7-7, drops down to prevent the transmitting capstan motor torque to the loading section.
Note that the take-up guide pole is operated by the relay gear which meshes with the gear on the outside of the loading ring assembly to drive the lock plate drive gear. Only part of the lock plate drive gear's outside rim has teeth on it so that the gear turns the L-link lock plate by just the angle required to push the take-up guide pole in the V-groove.
During the assembling of the loading block, phases are set as shown below. Assembly is performed in the FULL LOCK mode (without cassette housing)

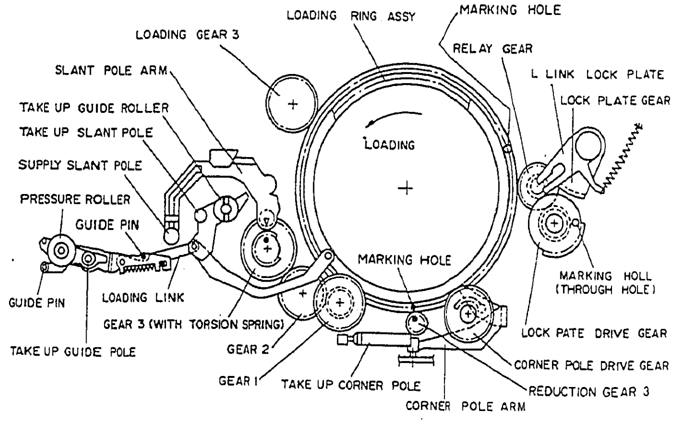

LOADING RING ASSY
MARKING HOLE
LOADING GEAR 3
RELAY GEAR
SLANT POLE ARM
L LINK LOCK PLATE
LOCK PLATE GEAR
TAKE UP GUIDE ROLLER
TAKE UP SLANT POLE
LOADING
SUPPLY SLANT POLE
PRESSURE ROLLER
GUIDE PIN
MARKING HOLE
MARKING HOLL
(THROUGH HOLE)
GUIDE PIN
LOADING LINK
GEAR 3 (WITH TORSION SPRING)
LOCK PATE DRIVE GEAR
TAKE UP GUIDE POLE
GEAR 2
CORNER POLE DRIVE GEAR
GEAR I
TAKE UP CORNER POLE
REDUCTION GEAR 3
CORNER POLE ARM

Fig. 7-5 Loading Drive Mechanism (2)

Assembly must be done with slant pole arm (Δ) mark and gear 3 (O) mark aligned.
Assembly is done by aligning the hole in the chassis with the hole in the loading ring assembly.
Assembly is done by aligning the hole in the chassis with the hole in the lock plate drive gear that presses the pressure roller. Assembly must be done with reduction gear 3 (.) and loading ring assembly (Δ) marks aligned.

6. PRESSURE ROLLER COMPRESSION MECHANISM (Fig. 7-6)

Fig. 7-6 shows the pressure roller compression mechanism.
Setting the pressure roller and take-up guide pole in their assigned positions transmits torque from the loading motor through reduction gears 1 and 2 to the drive gear. The cam arm pin is guided into the guide groove on the top of the drive gear (side in contact with the chassis). The pin at the opposite end of the cam arm inserts into the hole drilled in the end of the lock plate link so that loading motor rotation pushes the lock plate link to the right.
This turns the pressure roller lock plate clockwise to press the pressure roller against the capstan shaft. After the pressure roller is compressed against the capstan shaft, the continued rotation of the loading motor pushes the lock plate link further to the right. However, because the pressure roller lock plate can only turn counterclockwise, the pressure roller drive arm turns counterclockwise around the take-up arm stopper.
The rotating action pulls the pressure roller spring to generate roller pressure.
As the pressure roller lock plate turns, the take-up tension pole also turns clockwise to remove slack tape.

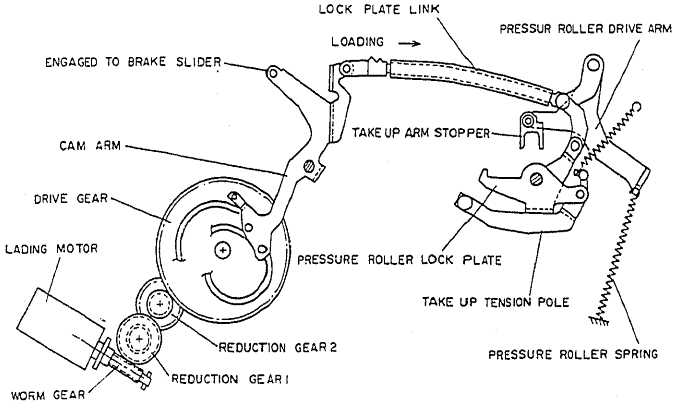

LOCK PLATE LINK
LOADING →
PRESSUR ROLLER DRIVE ARM
ENGAGED TO BRAKE SLIDER
TAKE UP ARM STOPPER
CAM ARM
DRIVE GEAR
LADING MOTOR
PRESSURE ROLLER LOCK PLATE
TAKE UP TENSION POLE
REDUCTION GEAR 2
PRESSURE ROLLER SPRING
REDUCTION GEAR I
WORM GEAR

Fig. 7-6 Pressure Roller Lock Mechanism

7. REEL BLOCK DRIVE MECHANISM (Fig. 7-7)

The capstan motor turns a belt to drive the drive pulley gear.
The torque transmitted to the drive pulley gear drives the reel disks and loading. The gear inside the drive pulley gear is linked to change gear L.
Changing gear L to the Hi position causes loading gear 1 to mesh with the drive pulley gear and transmit capstan motor torque through 1) loading gears 1 and 2, 2) the worm gear, and 3) loading gear 3 to the loading ring assembly for loading.
When change gear L is in the opposite position, Lo, there is no loading.
Gear B links with the gear inside the drive pulley gear. The torque transmitted to gear B goes through gear A to change gear R. Change gear R's torque is transmitted to the clutch gear assembly which meshes with change gear R.
The clutch gear assembly contains a slip mechanism which does not transmit the strong torque that goes to the reel disks in fast forward and rewind, but sends weak torque to the reel disk in playback and unloading.
In other words, setting change gear R to Hi sends torque during playback and unloading; setting change gear R to Lo sends torque during fast forward and rewind.
The clutch gear assembly is linked to idler gears T and S. Idler gears T and S swing to the right and left, as determined by the direction of clutch gear assembly rotation, to send torque to the reel disks.
The take-up sub-brake pushes on reel gear T to apply weak back tension and drive the take-up reel disk.
The brake slider operates the take-up sub-brake. The main brake T also pushes to relay gear T.
Relay gear S, which drives the supply reel disk, is linked to main brake S.
The supply sub-brake applies back tension directly to the supply reel disk.
Main brake S is linked to the brake operation arm. The brake operation arm has a groove into which the pin on the eject operation arm is inserted. The end of the eject

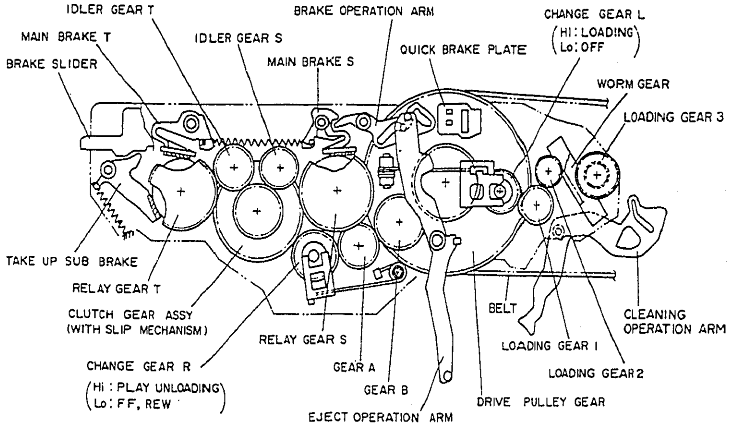

IDLER GEAR T
BRAKE OPERATION ARM
CHANGE GEAR L
(HI: LOADING
Lo: OFF)
MAIN BRAKE T
IDLER GEAR S
QUICK BRAKE PLATE
BRAKE SLIDER
MAIN BRAKE S
WORM GEAR
LOADING GEAR 3
TAKE UP SUB BRAKE
RELAY GEAR T
CLUTCH GEAR ASSY
(WITH SLIP MECHANISM)
BELT
CLEANING
OPERATION ARM
RELAY GEAR S
LOADING GEAR I
CHANGE GEAR R
GEAR A
LOADING GEAR 2
(Hi : PLAY UNLOADING
Lo: FF, REW)
GEAR B
DRIVE PULLEY GEAR
EJECT OPERATION ARM

Fig. 7-7 R Block Drive Mechanism

8. SL CHASSIS TIMING CHART (Fig. 7-8)

Fig. 7-8 is the chart of timing for the SL mechanism. ON shows that the operating part is pressed against another part or that it drives another part. OFF shows that the pressure is released or that there is absolutely no operation.

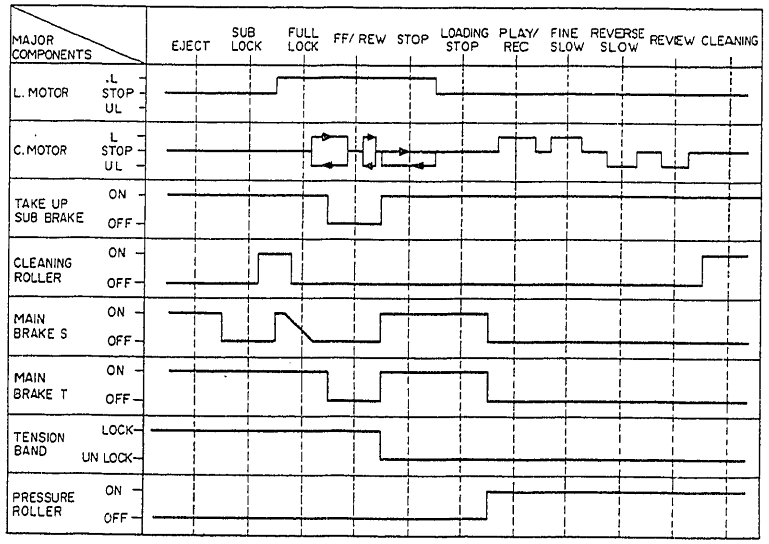


Fig. 7-8 SL Chassis Timing Chart

9. GUIDE GROOVE TRACE (Fig. 7-9)

Fig. 7-9 shows the SL chassis guide groove.
When a cassette is inserted into the housing, the pressure roller and take-up guide pole are at point (A) and the take-up guide roller and take-up slant pole are at point (C).
The loading motor turns, as Fig. 7-4 shows, to turn the supply guide pin clockwise and move the pressure roller and take-up guide pole to point (B).
Capstan motor torque is transmitted to the loading ring assembly and turns it counterclockwise to start the take-up guide roller and take-up slant pole moving from point (C) and, at the same time, the pressure roller and take-up guide pole moving from point (B).
The passing of the pressure roller past point (D) moves guide arm 2 counterclockwise slightly to make the groove on side (D) wider than the groove on side (E).
this guides the take-up guide roller and take-up slant pole to groove (E) after they pass point (F) during unloading.
The passing of take-up guide roller and take-up slant

pole past point (H) turns guide arm 1 clockwise to make the groove on side (G) wider than the groove on side (H). This guides the pressure roller and take-up guide pole into the groove on side (G) and sets it into its assigned position.

The take-up guide roller and take-up slant pole continue to move further causing the guide pin built into the loading link (see Fig. 7-4) to move past groove (I), to guide the take-up slant pole into groove (J), and to guide the take-up guide roller into the groove on side (K) and push it into the arm stopper.

The guide roller spring (shown in Fig. 7-4) applies pressure to press the take-up guide roller into the arm stopper.

Unloading is loading by the reverse procedure.

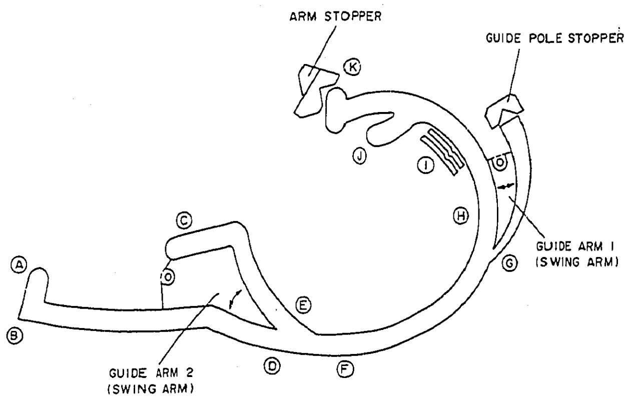

ARM STOPPER
GUIDE POLE STOPPER
Ⓚ
Ⓙ
Ⓘ
Ⓗ
Ⓒ
Ⓐ
Ⓑ
Ⓔ
Ⓓ
Ⓕ
Ⓖ
GUIDE ARM 1 (SWING ARM)
GUIDE ARM 2 (SWING ARM)

Fig. 7-9 Guide Groove Track

APPENDIX

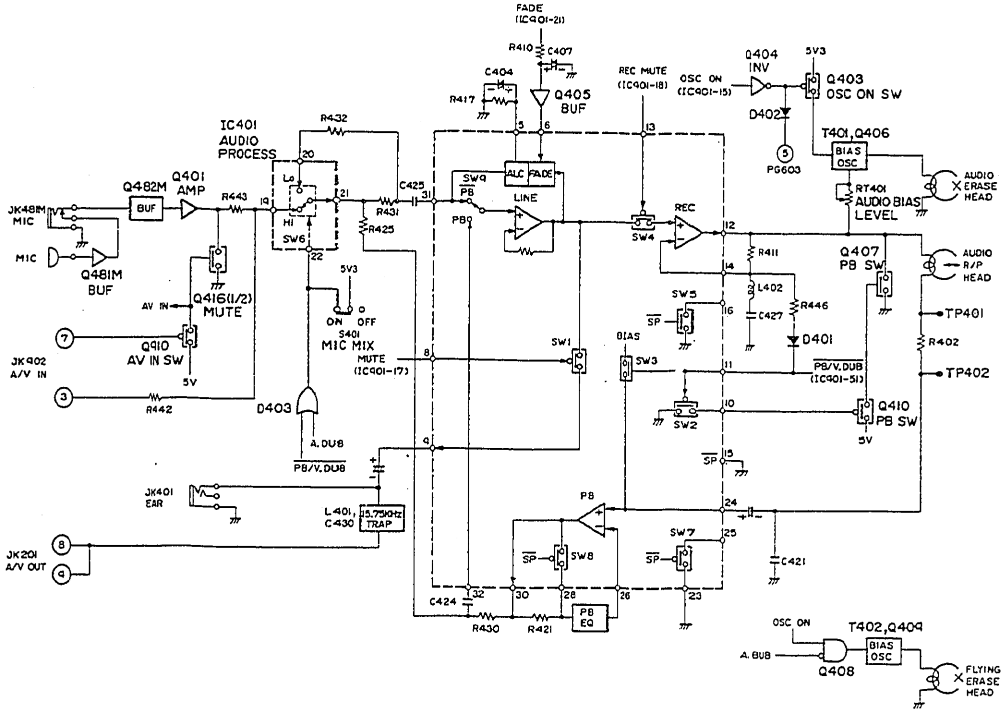

FADE (IC901-21)
R410
C407
C404
R417
Q405 BUF
REC MUTE (IC901-18)
OSC ON (IC901-15)
Q404 INV
5V3
Q403 OSC ON SW
D402
⑤ PG603
T401,Q406
BIAS OSC
AUDIO ERASE HEAD
RT401 AUDIO BIAS LEVEL
IC401 AUDIO PROCESS
R432
Q401 AMP
Q482M BUF
R443
JK481M MIC
MIC
Q481M BUF
Lo
HI
SW6
C425
R431
R425
SW9
PB
ALC
FADE
LINE
REC
SW4
Q407 PB SW
AUDIO R/P HEAD
R411
L402
C427
R446
D401
TP401
R402
TP402
SW5
SP
5V3
ON OFF
S401 MIC MIX
AV IN
Q416(1/2) MUTE
⑦
Q910 AV IN SW
JK902 A/V IN
5V
③
R442
D403
A.DUB
PB/V.DUB
MUTE (IC901-17)
SW1
BIAS
SW3
PB/V.DUB (IC901-51)
SW2
Q410 PB SW
5V
JK401 EAR
L401, C430
15.75KHz TRAP
JK201 A/V OUT
⑧
⑨
PB
SW8
SW7
C421
C424
R430
R421
PB EQ
OSC ON
A.BUB
Q408
T402,Q409
BIAS OSC
FLYING ERASE HEAD

Fig. 8-1. AUDIO SIGNAL PROCESSING BLOCK DIAGRAM

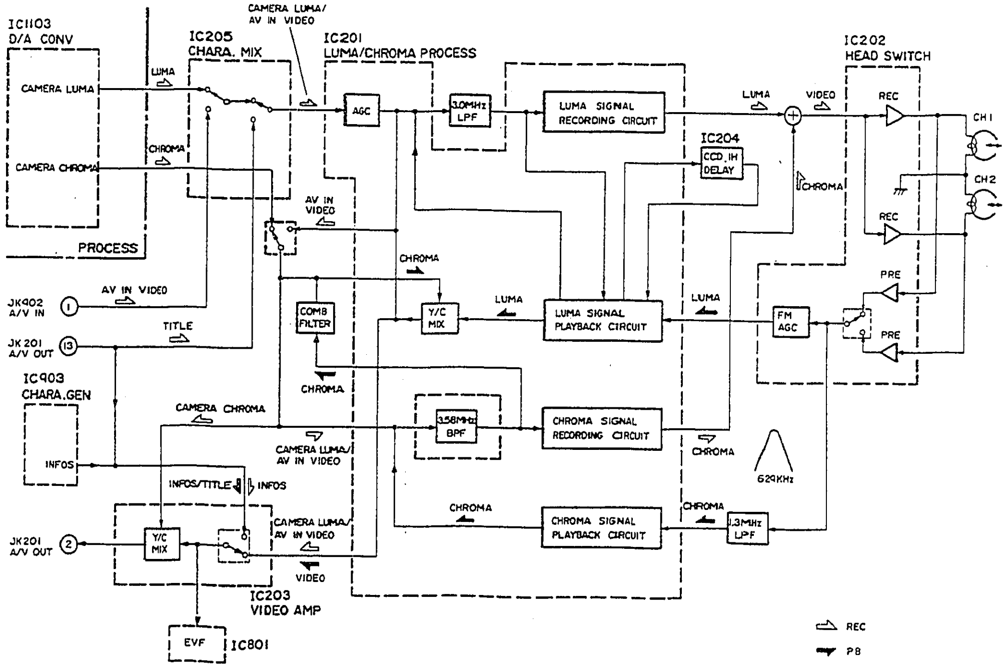

IC1103 D/A CONV
CAMERA LUMA
CAMERA CHROMA
PROCESS
LUMA
CHROMA
IC205 CHARA. MIX
CAMERA LUMA/ AV IN VIDEO
IC201 LUMA/CHROMA PROCESS
AGC
3.0MHz LPF
LUMA SIGNAL RECORDING CIRCUIT
IC204 CCD,1H DELAY
LUMA
VIDEO
IC202 HEAD SWITCH
REC
CH1
CH2
REC
CHROMA
PRE
PRE
FM AGC
AV IN VIDEO
CHROMA
JK902 A/V IN ①
AV IN VIDEO
JK201 A/V OUT ⑬
TITLE
COMB FILTER
Y/C MIX
LUMA
LUMA SIGNAL PLAYBACK CIRCUIT
LUMA
CHROMA
IC903 CHARA.GEN
INFOS
CAMERA CHROMA
CAMERA LUMA/ AV IN VIDEO
3.58MHz BPF
CHROMA SIGNAL RECORDING CIRCUIT
CHROMA
629KHz
INFOS/TITLE
INFOS
CHROMA
CHROMA SIGNAL PLAYBACK CIRCUIT
CHROMA
1.3MHz LPF
JK201 A/V OUT ②
Y/C MIX
CAMERA LUMA/ AV IN VIDEO
VIDEO
IC203 VIDEO AMP
EVF
IC801
REC
PB

Fig. 8-2. SIMPLIFED VIDEO CIRCUIT

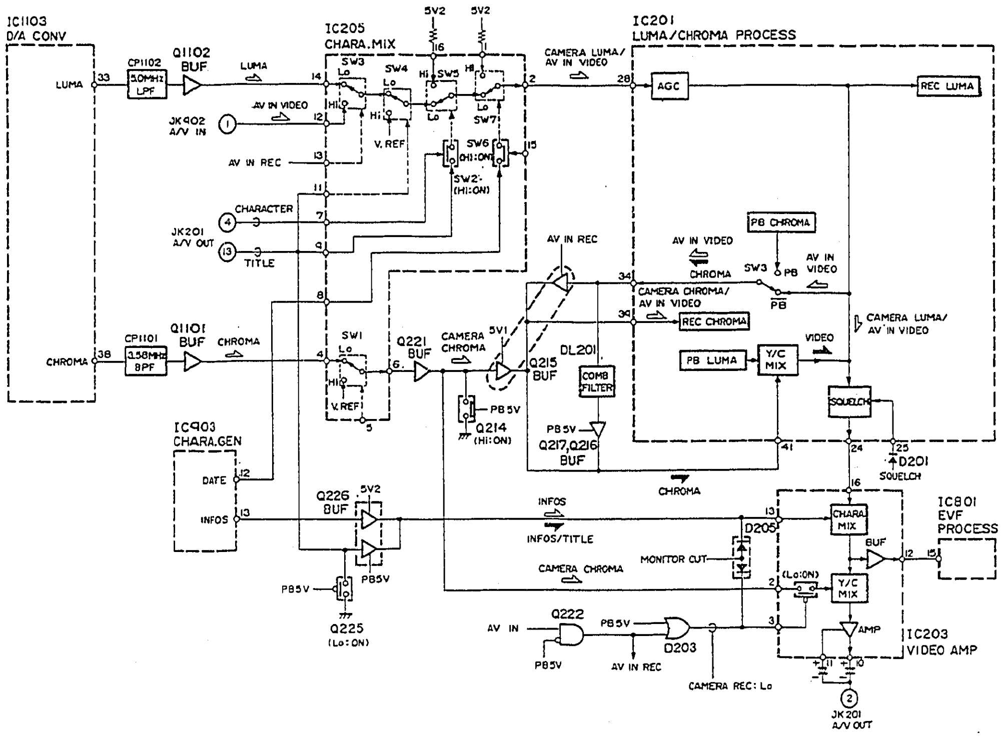

IC1103
D/A CONV
LUMA
CHROMA
CP1102
5.0MHz LPF
Q1102
BUF
LUMA
CP1101
3.58MHz BPF
Q1101
BUF
CHROMA
JK902
A/V IN
AV IN VIDEO
AV IN REC
CHARACTER
JK201
A/V OUT
TITLE
IC205
CHARA.MIX
SW3
SW4
SW5
SW7
SW6
SW2
(Hi:ON)
V.REF
SW1
5V2
IC903
CHARA.GEN
DATE
INFOS
Q226
BUF
Q225
(Lo:ON)
P85V
Q221
BUF
CAMERA CHROMA
5V1
Q214
(Hi:ON)
Q215
BUF
DL201
COMB FILTER
Q217,Q216
BUF
CAMERA LUMA/
AV IN VIDEO
AV IN REC
IC201
LUMA/CHROMA PROCESS
AGC
REC LUMA
PB CHROMA
AV IN VIDEO
CHROMA
SW3
PB
CAMERA CHROMA/
AV IN VIDEO
REC CHROMA
PB LUMA
Y/C MIX
VIDEO
SQUELCH
D201
SQUELCH
INFOS
INFOS/TITLE
D205
MONITOR CUT
CAMERA CHROMA
AV IN
Q222
D203
AV IN REC
CAMERA REC: Lo
CHARA MIX
BUF
Y/C MIX
AMP
(Lo:ON)
IC203
VIDEO AMP
IC801
EVF
PROCESS
JK201
A/V OUT

Fig. 8-3. VIDEO INPUT/OUTPUT CIRCUIT BLOCK DIAGRAM

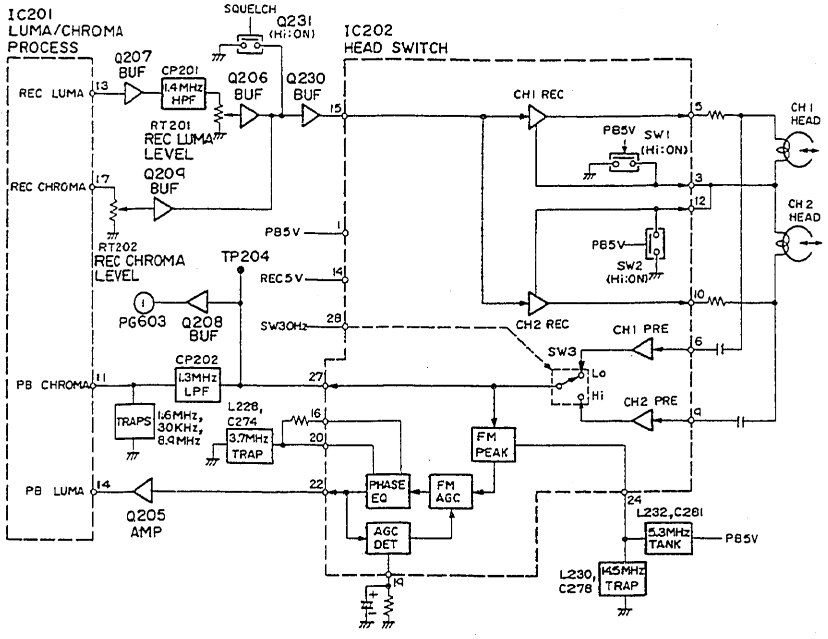

IC201
LUMA/CHROMA
PROCESS
REC LUMA
REC CHROMA
PB CHROMA
PB LUMA
Q207
BUF
CP201
1.4MHz HPF
RT201
REC LUMA LEVEL
Q206
BUF
SQUELCH
Q231
(Hi:ON)
Q230
BUF
Q209
BUF
RT202
REC CHROMA LEVEL
TP204
PG603
Q208
BUF
CP202
1.3MHz LPF
TRAPS
1.6MHz,
30KHz,
8.9MHz
L228,
C274
3.7MHz TRAP
Q205
AMP
IC202
HEAD SWITCH
P85V
REC5V
SW30Hz
CH1 REC
CH2 REC
P85V
SW1
(Hi:ON)
SW2
(Hi:ON)
CH1 PRE
CH2 PRE
SW3
Lo
Hi
FM PEAK
PHASE EQ
FM AGC
AGC DET
L232,C281
5.3MHz TANK
L230,
C278
14.5MHz TRAP
CH1 HEAD
CH2 HEAD

Fig. 8-4. VIDEO HEAD SWITCHING CIRCUIT BLOCK DIAGRAM

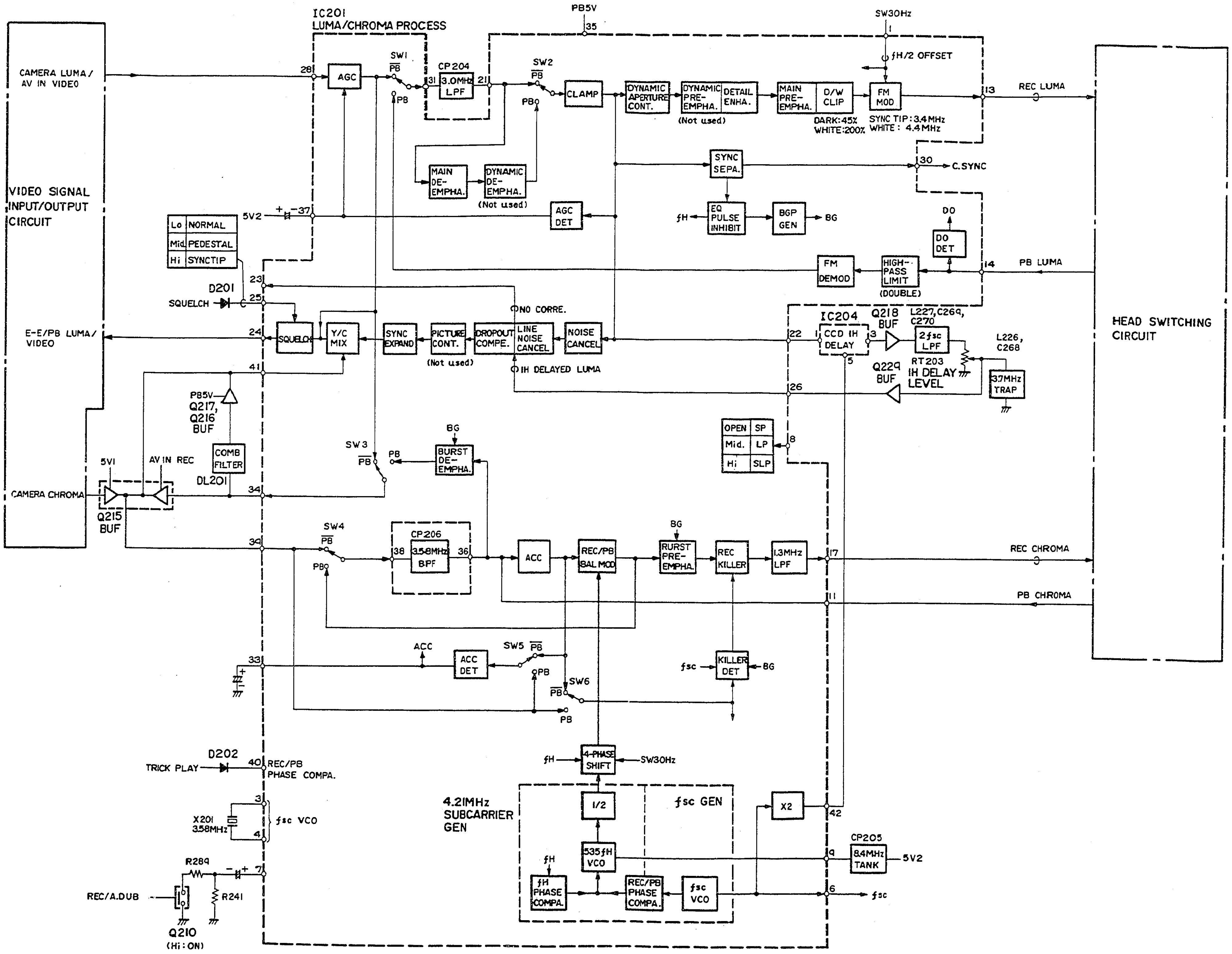

IC201
LUMA/CHROMA PROCESS
PB5V
SW30Hz
CAMERA LUMA/ AV IN VIDEO
AGC
SW1
CP204
3.0MHz LPF
SW2
CLAMP
DYNAMIC APERTURE CONT.
DYNAMIC PRE-EMPHA.
DETAIL ENHA.
(Not used)
MAIN PRE-EMPHA.
D/W CLIP
DARK:45%
WHITE:200%
fH/2 OFFSET
FM MOD
SYNC TIP:3.4MHz
WHITE: 4.4MHz
REC LUMA
MAIN DE-EMPHA.
DYNAMIC DE-EMPHA.
(Not used)
SYNC SEPA.
C.SYNC
VIDEO SIGNAL INPUT/OUTPUT CIRCUIT
Lo NORMAL
Mid PEDESTAL
Hi SYNCTIP
5V2
AGC DET
EQ PULSE INHIBIT
BGP GEN
BG
fH
DO
DO DET
FM DEMOD
HIGH-PASS LIMIT
(DOUBLE)
PB LUMA
D201
SQUELCH
NO CORRE.
E-E/PB LUMA/ VIDEO
SQUELCH
Y/C MIX
SYNC EXPAND
PICTURE CONT.
(Not used)
DROPOUT COMPE.
LINE NOISE CANCEL
NOISE CANCEL
1H DELAYED LUMA
IC204
CCD 1H DELAY
Q218 BUF
L227,C269, C270
2fsc LPF
L226, C268
RT203
Q229 BUF
1H DELAY LEVEL
3.7MHz TRAP
HEAD SWITCHING CIRCUIT
PB5V
Q217, Q216 BUF
COMB FILTER
DL201
5V1
AV IN REC
CAMERA CHROMA
Q215 BUF
SW3
PB
BG
BURST DE-EMPHA.
OPEN SP
Mid. LP
Hi SLP
SW4
CP206
3.58MHz BPF
ACC
REC/PB BAL MOD
BG
BURST PRE-EMPHA.
REC KILLER
1.3MHz LPF
REC CHROMA
PB CHROMA
ACC
SW5
ACC DET
SW6
fsc
KILLER DET
BG
D202
TRICK PLAY
REC/PB PHASE COMPA.
fH
4-PHASE SHIFT
SW30Hz
4.21MHz SUBCARRIER GEN
1/2
fsc GEN
X2
X201 3.58MHz
fsc VCO
535fH VCO
CP205
8.4MHz TANK
5V2
R289
R241
fH
fH PHASE COMPA.
REC/PB PHASE COMPA.
fsc VCO
fsc
REC/A.DUB
Q210
(Hi: ON)
28
31
21
35
1
13
30
37
14
23
25
24
22
3
5
41
26
8
34
34
38
36
17
11
33
40
3
4
42
9
7
6

Fig. 8-5. LUMINANCE/CHROMINANCE SIGNAL PROCESSING BLOCK DIAGRAM

HITACHI

HITACHI SALES CORPORATION. TOKYO JAPAN
Head Office : THE HITACHI ATAGO BLDG. No. 15-12, 2-Chome
Nishi-Shinbashi Minato-Ku, Tokyo 105, Japan
Tel :03-3502-2111

AMERICA

HITACHI HOME ELECTRONICS (AMERICA), INC.

Headquarters, Western Regional Office
401 West Artesia Boulevard, Compton,
California 90220 U.S.A.
Tel:213-537-8383 Fax:213-631-4475

Eastern Regional Office

1290 Wall Street West, Lyndhurst, New
Jersey 07071 U.S.A.
Tel:201-935-8980 Fax:201-935-4869

Mid-Western Regional Office

1400 Morse Ave., Elk Grove Village, Illinois.
60007 U.S.A.
Tel:708-593-1550 Fax:708-593-2436

Southern Regional Office

510 Plaza Drive, College Park, Georgia
30349, U.S.A
Tel:404-763-0360 Fax:404-763-0416

HITACHI SALES CORPORATION OF HAWAII. INC.

3219 Koapaka Street, Honolulu, Hawaii,
96819 U.S.A.
Tel:808-836-3621 Fax:808-833-3449

HITACHI (HSC) CANADA INC.

Montreal Office & Manufacturing Division.
3300 Trans-Canada Highway, pointe Claire,
Quebec, H9R 1B1, Canada
Tel:514-697-9150 Fax:514-697-2209

HITACHI SALES CORPORATION DE PANAMA, S.A

Apartado postal 7657, Panama 5, Panama City,
Rep. of panama
Tel:63-65-00, 63-64-91 Fax:64-8827

HITACHI SALES CENTROAMERICANA, S.A.

Apartado Postal 10272-1000
San Rafael de Escazu, San Jose, Costa Rica
Tel:28-20-11 Fax:28-54-77

HITACHI SALES CORPORATION DE EL SALVADOR, S.A.

Apartado Postal N° 818 San Salvadore,
El Salvador 11a, Calle Oriente, N° 130
Tel:21-29-22, 22-60-14 Fax:22-8372

COMPANIA ELECTRONICA COLOMBIANA, S.A

Apatado Postal 14933
Calle 5a, N° 19-A-31, Bogota D.E.
Tel:47-91-16, 47-17-83 Fax:201-8710

MAYORCA - HITACHI, C.A.

Apartado Postal 61189 Caracas-Venczucla 3ra.
Transversal, entrc 1ra. Av. y Av.
Andros Bello Centro Comercial Cayorma.
Piso 3 Los Palos Grandes
Tel:284-90-67, 284-03-11 Fax:283-32-24

ELJURI HITACHI, S.A.

P.O. Box 738 Ave. Huayna Capac 8-57
Cucnca-Ecuador
Tel:831-188, 831-385 Fax:830-797

EUROPE

HITACHI SALES EUROPA GmbH

Rungedamm 2, 2050 Hamburg 80, Germany
Tel:040-734110 Fax:040-7340134

HITACHI SALES (U.K.) Ltd.

Hitachi House, Station Road, Hayes,
Middlesex UB3 4DR, England
Tel:081-848-8787 Fax:081-561-4565

HITACHI FRANCE (RADIO-T.V. ELECTRO-MENAGER) S.A.

95-101 Rue Charles-Michels,
93200 Saint-Denis, France
Tel:1-48-21-6015 Fax:1-42-43-6697

HITACHI SALES SCANDINAVIA AB

Domnarvsgatan 29 Lunda, Box 62,
S-163 91 Spanga, Sweden
Tel:08-7955600 Fax:08-7616250

HITACHI SALES NORWAY A/S

Postboks 68, Bruket 31, N-1620
Gressvik, Norge
Tel:09-328255 Fax:09-329340

SUOMEN HITACHI OY

Takojankatu 5, SF-15800 Lahti 80, Finland
Tel:918-527800 Fax:918-515273

HITACHI SALES A/S

Kuldyssen 13, DK-2630, Taastrup, Denmark
Tel:42-999200 Fax:42-999392

HITACHI SALES A.G.

Bahnhofstrasse, 19, 5600 Lenzburg,
Switzerland
Tel:064-50 22 11 Fax:064-51 60 56

HITACHI SALES WARENHANDELS GmbH

Kreuzgasse 27, A 1180 Wien, Austria
Tel:0222-421678, 0222-421679
Fax:0222-4393675

HITACHI SALES ITALIANA, S.p.A.

Via Ludovico di Breme 9, 20156 Milano, Italy
Tel:02-30231 Fax:2-33400021

HITACHI SALES BELGIUM S.A./ N.V.

Chaussee de Namur 56, B-1400 Nivelles,
Belgium
Tel:067-21-71-81, 067-21-79-81
Fax:67-21-8078

HITACHI SALES IBERICA, S.A.

Gran Via Carlos Tercero. 101, 1-1,
Barcelona-08028 Spain
Tel:3-330-8652 Fax:3-339-7839

HITACHI SALES (HELLAS) S.A.

91 Falirou Street 11741 Athens, Greece
Tel:9229300 Fax:1-9235566

HITACHI SALES NETHERLAND B.V.

Industrieweg 17-19, 3762 EG Soest,
Postbus 465, 3760 AL Soest, Holland
Tel:02155-16544 Fax:02155-17324

ASIA, AFRICA, OCEANIA

HITACHI SALES (MALAYSIA) SDN. BHD.

Wisma Hitachi, No.2, Loronge 13/6A, 46200
Petaling Jaya, Selangor, Malaysia
Tel:03-7573455 Fax:03-7556090

HITACHI (SINGAPORE) PTE. LTD.

PSA Warehousing Services Alexandra Distripark
Block 1, #01-03, Pasir Panjang Road
Singapore 0511
Tel:2787177 Fax:2734450

HITACHI SALES (THAILAND) LTD.

2240-46, New Petchburi Road, Bankapi,
Hueykuang Bangkok, Thailand
Tel:2-314-2741 Fax:2-319-2460

HITACHI ELECTRIC SERVICE CO., (HONG KONG) LTD.

3rd Floor Leun Tai Industrial Bldg., 72-76
Kwai Cheong Road Kwai Chung N.T.,
Hong Kong
Tel:420-4101, 424-0126 Fax:480-4493

Hitachi Sales Corporation of Taiwan

Room A, 11F1. No.180, Sec. 4 Chung Hsiao
E. Road, Taipei Taiwan, R. O. C.
Tel:02-721-6686 Fax:02-752-3211

HITACHI PRODUCTIONS MAROC ELECTRONIQUES DOMESTIQUES S.A

Rue du Havre, Casablanca, Morocco
Tel:212-2-30-73-68, 212-2-30-73-57
Fax:212-2-31-67-42

HITACHI CANARIAS S.A.

Calle San-Francisco No. 19, 38002 Santa Cruz
de Tenerife Canary Islands
Tel:9-22-246498 Fax:9-22-242310

HITACHI SALES AUSTRALIA PTY LTD.

153 Keys Road, Moorabbin, Victoria 3189
Australia
Tel:555-8722 Fax:3-532-1815

VM-4400A TK No.3518E TOKAI

Copyright © Hitachi, Ltd. 1991. All rights reserved.

Printed in Japan (K)

HITACHI

SERVICE MANUAL

TK

No.3616E,F

VM-4400A (U,C)
VM-4450AW,A (PX)
VM-5400A (U,C)

Technical Data *Données Techniques*

SUPPLEMENT

This supplementary manual covers modification to the schematic and circuit board diagrams to improve the date/time battery problem.
Use this together with the manuals listed below.

MANUALS RELATED TO THE VM-4400A/4450A

TITLE	MANUAL No.
VM-4400A/4450A Technical Data	3517E
VM-4400A/4450A Technical Information	3518E
VM-RF71A Technical Data	2996E
VM-AC66A/AC67A Technical Data	3598E

MANUALS RELATED TO THE VM-5400A

TITLE	MANUAL No.
VM-5400A Technical Data	3526E
VM-5400A Technical Information	3527E
VM-RF71A Technical Data	2996E
VM-AC66A/AC67A Technical Data	3598E

SUPPLÉMENT

Ce supplément est consacré aux modifications apportées dans les schémas de principe et de câblage qui ont pour but d'apporter une solution aux problèmes inhérants à la pile d'alimentation d'affichage de la date/de l'heure.
Ce supplément droit être utilisé en même temps que les manuels mentionnés ci-dessous.

MANUELS RELATIFS AUX MODÈLES VM-4400A/4450A

TITRE	NO. DE MANUEL
Données techniques de VM-4400A/4450A	3519F
Renseignements techniques de VM-4400A/4500A	3518E
Données techniques de VM-RF71A	2996E
Données techniques de VM-AC66A/AC67A	3599F

MANUELS RELATIFS AU MODÈLE VM-5400A

TITRE	NO. DE MANUEL
Données techniques de VM-5400A	3528F
Renseignements techniques de VM-5400A	3527E
Données techniques de VM-RF71A	2996E
Données techniques de VM-AC66A/AC67A	3599F

SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

VIDEO CAMERA／RECORDER

December 1991

TOKAI WORKS

MODIFICATION

A diode [D913: 1SS254 (P#: 5339131)] is added between pins 1 and 7 of the backup detector (IC902: REG/VOLT. DET) in the system control circuit as shown below.

Model:	VM-4400A	Serial No.	from XXX16001
	VM-4450A(PX)		from XXXX2001
	VM-4450A(W)		from XXXXX901
	VM-5400A		from XXXX2001

PHENOMENA:
If the date/time battery [lithium battery (CR2025)] is installed within four minutes after removing the power supply [Power Adapter/Charger (VM-AC66A or VM-AC67A)] from the unit, the unit may not turn on.

REASON:
When the power supply is removed from the unit after installing the power supply without the lithium battery and turning the unit off, the B+ power supply voltage decreases.
If the lithium battery is installed with the B+ power supply voltage within 1V to 3V, the reset detector (RESET DET) in IC902 malfunctions.
As a result, the main system control microprocessor (IC901: M-µP) is not initialized, and the unit does not turn on.
In order to improve the problem, D913 is added.

COUNTERMEASURE (TENTATIVE):
If above problem occurs, leave the unit for five minutes or more after removing the power supply and lithium battery from the unit.
After that, install the lithium battery first.

MODIFICATIONS

Une diode [D913: 1SS254 (no. rf. de pièce: 5339131)] a été rajoutée entre les broches 1 et 7 du détecteur d'alimentation de secours (circuit intégré IC902: REG/VOLT. DET) dans le circuit de commande de système comme indiqué ci-dessous.

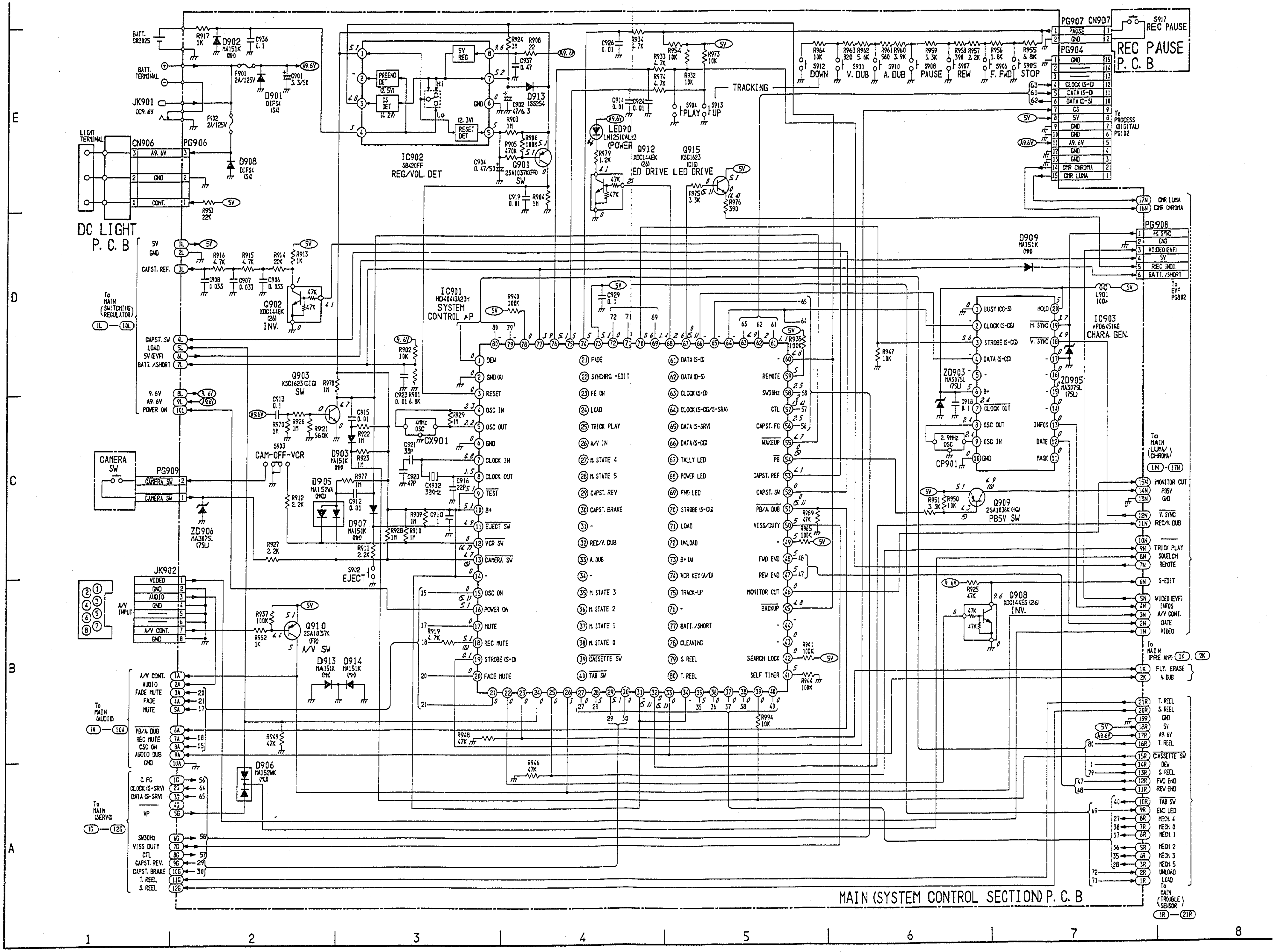
Modèle:	VM-4400A	No. de séries	à partir de XXX16001
	VM-4450A (PX)		à partir de XXXX2001
	VM-4450A (W)		à partir de XXXXX901
	VM-5400 A		à partir de XXXX2001

PHÉNOMÈNE:
Si la pile d'alimentation d'affichage de la date/de l'heure [pile au lithium (CR2025)] est mise en place en moins de quatre minutes après avoir débranché l'alimentation [adaptateur d'alimentation secteur/chargeur (VM-AC66A ou VM-67A)] de cet appareil, il peut se produire que l'appareil refuse de se mettre en marche.

RAISON:
Lorsque l'alimentation est isolée de l'appareil après avoir mis en place la source d'alimentation et que la pile au lithium n'est pas en place puis que l'appareil est arrêté, la tension d'alimentation B+ diminue.
Si la pile au lithium est installée alors que la tension d'alimentation B+ se situe dans les limites de 1 V à 3 V, le détecteur de réinitialisation (RESET DET) interne au circuit intégré IC902 ne réagit pas normalement. Il en résulte que le microprocesseur de commande de système principal (circuit intégré IC1901: M-µP) n'est pas réinitialisé de sorte que l'appareil refuse de se mettre en marche.
C'est la raison pour laquelle la diode D913 a été rajoutée afin d'apporter une solution à ce problème.

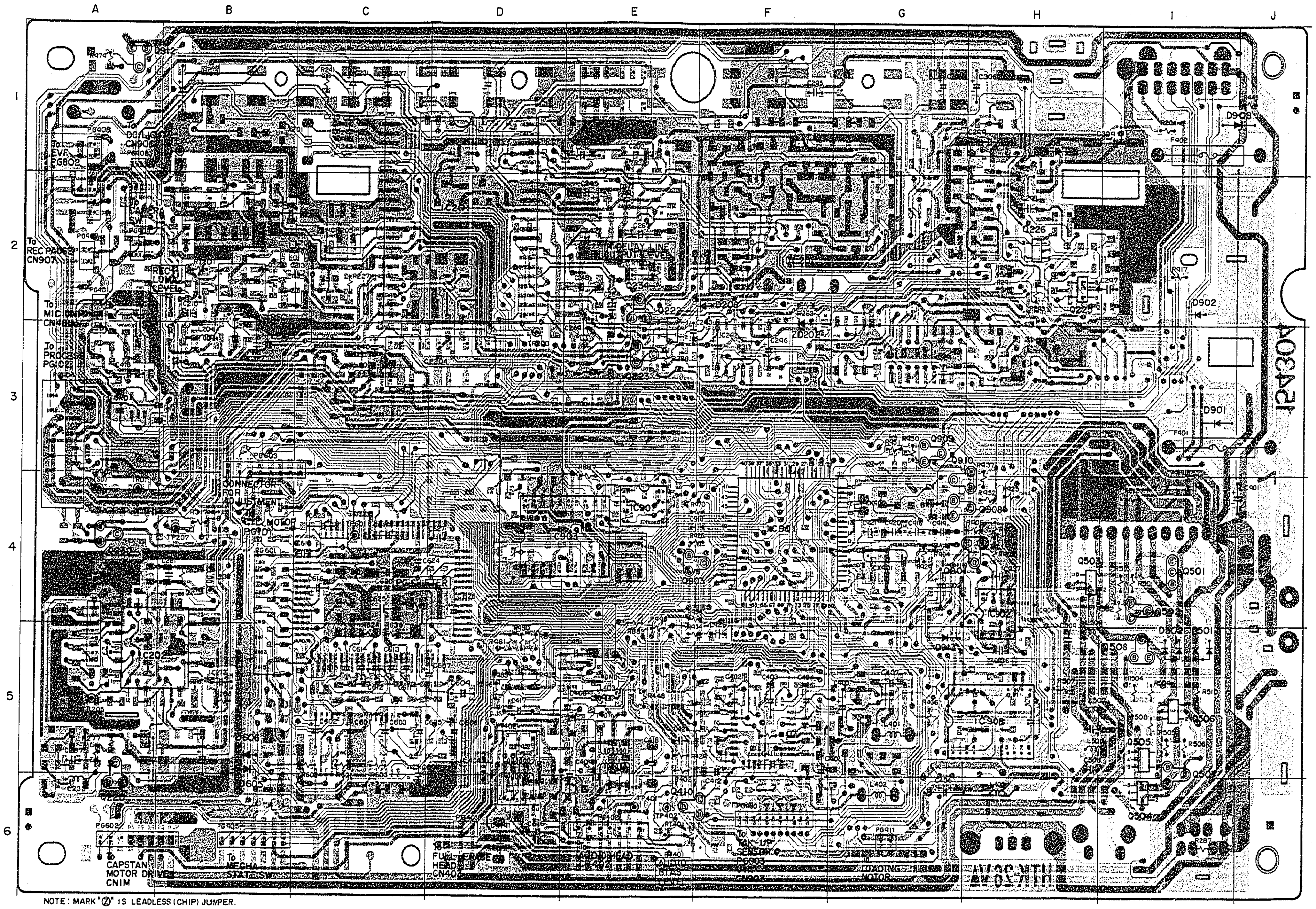
MESURES PRÉVENTIVES (PROVISOIRE):
Si le phénomène décrit ci-dessus se produit, laisser l'appareil au repos pendant au moins cinq minutes après avoir isolé l'alimentation et retiré la pile au lithium de l'appareil. Ensuite, remettre d'abord la pile au lithium en place.

MAIN (SYSTEM CONTROL SECTION) SCHEMATIC DIAGRAM



REC PAUSE P. C. B
S917 REC PAUSE
PG907 CN907
PG904
To PROCESS (DIGITAL) PG102
DC LIGHT P. C. B
LIGHT TERMINAL
CN906
PG906
BATT. CR2025
BATT. TERMINAL
JK901 DC9.6V
F901 2A/125V
F102 2A/125V
D901 D1FS4
D908 D1FS4
D902 MA151K
IC902 S8420FF REG/VOL. DET
5V REG
PREEND DET
CS DET
RESET DET
Q901 2SA1037K(FR) SW
D913 1SS254
S912 DOWN
S911 V. DUB
S910 A. DUB
S908 PAUSE
S907 REW
S906 F. FWD
S905 STOP
S904 PLAY
S913 UP
TRACKING
LED901 LN1251CAL23 (POWER)
Q912 XDC144EK LED DRIVE
Q915 KSC1623 LED DRIVE
To MAIN (SWITCHING REGULATOR) (1L)—(10L)
Q902 XDC144EK INV.
IC901 HD404433A23H SYSTEM CONTROL µP
IC903 µPD6451AG CHARA. GEN.
ZD903 MA3075L
ZD905 MA3075L
CP901
CX901
CX902 32kHz
Q903 KSC1623 SW
S903 CAM-OFF-VCR
D903 MA151K
D905 MA152WA
D907 MA151K
S902 EJECT
CAMERA SW
PG909
ZD906 MA3075L
JK902 A/V INPUT
Q910 2SA1037K A/V SW
D913 MA151K
D914 MA151K
D906 MA152WK
To MAIN (AUDIO) (1A)—(10A)
To MAIN (SERVO) (1G)—(12G)
PG908
To EVF PG802
D909 MA151K
L901 100µ
Q909 2SA1036K PB5V SW
Q908 XDC144ES INV.
To MAIN (LUMA/CHROMA) (1N)—(17N)
To MAIN (PRE AMP) (1K), (2K)
To MAIN (TROUBLE SENSOR) (1R)—(21R)
MAIN (SYSTEM CONTROL SECTION) P. C. B
1
2
3
4
5
6
7
8
A
B
C
D
E

MAIN CIRCUIT BOARD DIAGRAM (COMPONENT SIDE)


A
B
C
D
E
F
G
H
I
J
1
2
3
4
5
6
To EVR PG802
To REC/PAUSE CN907
To PROCESS PG102
DELAY LINE
CONNECTOR FOR ADJUSTMENT
CTL MOTOR
PG SHUTTER
TP207
D908
D902
D901
Q501
Q503
Q505
Q508
IC301
IC901
IC902
IC903
D503
R501
R506
R510
PG602
PG605
PG911
To CAPSTAN MOTOR DRIVE CNIM
To MECHA STATE SW
To FULL ERASE HEAD CN401
AUDIO HEAD
To TAKE-UP SENSOR PG903 CN903
LOADING MOTOR
TP401
Q410
L402

NOTE: MARK "Ⓩ" IS LEADLESS (CHIP) JUMPER.

MAIN P.C.B (COMPONENT SIDE)

HITACHI

HITACHI SALES CORPORATION. TOKYO JAPAN
Head Office : THE HITACHI ATAGO BLDG. No. 15-12, 2-Chome
Nishi-Shinbashi Minato-Ku, Tokyo 105, Japan
Tel :03-3502-2111

AMERICA

HITACHI HOME ELECTRONICS (AMERICA), INC.
Headquarters, Western Regional Office
401 West Artesia Boulevard, Compton,
California 90220 U.S.A.
Tel :213-537-8383 Fax:213-631-4475

Eastern Regional Office
1290 Wall Street West, Lyndhurst, New
Jersey 07071 U.S.A.
Tel :201-935-8980 Fax:201-935-4869

Mid-Western Regional Office
1400 Morse Ave., Elk Grove Village, Illinois.
60007 U.S.A.
Tel :708-593-1550 Fax:708-593-2436

Southern Regional Office
510 Plaza Drive, College Park, Georgia
30349, U.S.A
Tel :404-763-0360 Fax:404-763-0416

HITACHI SALES CORPORATION OF HAWAII. INC.
3219 Koapaka Street, Honolulu, Hawaii,
96819 U.S.A.
Tel :808-836-3621 Fax:808-833-3449

HITACHI (HSC) CANADA INC.
Montreal Office & Manufacturing Division.
3300 Trans-Canada Highway, pointe Claire,
Quebec, H9R 1B1, Canada
Tel :514-697-9150 Fax:514-697-2209

HITACHI SALES CORPORATION DE PANAMA, S.A
Apartado postal 7657, Panama 5, Panama City,
Rep. of panama
Tel :63-65-00, 63-64-91 Fax:64-8827

HITACHI SALES CENTROAMERICANA, S.A.
Apartado Postal 10272-1000
San Rafael de Escazu, San Jose, Costa Rica
Tel :28-20-11 Fax:28-54-77

HITACHI SALES CORPORATION DE EL SALVADOR, S.A.
Apartado Postal N° 818 San Salvadore,
El Salvador 11a, Calle Oriente, N° 130
Tel :21-29-22, 22-60-14 Fax:22-8372

COMPANIA ELECTRONICA COLOMBIANA, S.A
Apatado Postal 14933
Calle 5a, N° 19-A-31, Bogota D.E.
Tel :47-91-16, 47-17-83 Fax:201-8710

MAYORCA - HITACHI, C.A.
Apartado Postal 61189 Caracas-Venczucla 3ra.
Transversal, entrc 1ra. Av. y Av.
Andros Bello Centro Comercial Cayorma.
Piso 3 Los Palos Grandes
Tel :284-90-67, 284-03-11 Fax:283-32-24

ELJURI HITACHI, S.A.
P.O. Box 738 Ave. Huayna Capac 8-57
Cucnca-Ecuador
Tel :831-188, 831-385 Fax:830-797

EUROPE

HITACHI SALES EUROPA GmbH
Rungedamm 2, 2050 Hamburg 80, Germany
Tel :040-734110 Fax:040-7340134

HITACHI SALES (U.K.) Ltd.
Hitachi House, Station Road, Hayes,
Middlesex UB3 4DR, England
Tel :081-848-8787 Fax:081-561-4565

HITACHI FRANCE (RADIO-T.V. ELECTRO-MENAGER) S.A.
95-101 Rue Charles-Michels,
93200 Saint-Denis, France
Tel :1-48-21-6015 Fax:1-42-43-6697

HITACHI SALES SCANDINAVIA AB
Domnarvsgatan 29 Lunda, Box 62,
S-163 91 Spanga, Sweden
Tel :08-7955600 Fax:08-7616250

HITACHI SALES NORWAY A/S
Postboks 68, Bruket 31, N-1620
Gressvik, Norge
Tel :09-328255 Fax:09-329340

SUOMEN HITACHI OY
Takojankatu 5, SF-15800 Lahti 80, Finland
Tel :918-527800 Fax:918-515273

HITACHI SALES A/S
Kuldyssen 13, DK-2630, Taastrup, Denmark
Tel :42-999200 Fax:42-999392

HITACHI SALES A.G.
Bahnhofstrasse, 19, 5600 Lenzburg,
Switzerland
Tel :064-50 22 11 Fax:064-51 60 56

HITACHI SALES WARENHANDELS GmbH
Kreuzgasse 27, A 1180 Wien, Austria
Tel :0222-421678, 0222-421679
Fax:0222-4393675

HITACHI SALES ITALIANA, S.p.A.
Via Ludovico di Breme 9, 20156 Milano, Italy
Tel :02-30231 Fax:2-33400021

HITACHI SALES BELGIUM S.A./ N.V.
Chaussee de Namur 56, B-1400 Nivelles,
Belgium
Tel :067-21-71-81, 067-21-79-81
Fax:67-21-8078

HITACHI SALES IBERICA, S.A.
Gran Via Carlos Tercero. 101, 1-1,
Barcelona-08028 Spain
Tel :3-330-8652 Fax:3-339-7639

HITACHI SALES (HELLAS) S.A.
91 Falirou Street 11741 Athens, Greece
Tel :9229300 Fax:1-9235566

HITACHI SALES NETHERLAND B.V.
Industrieweg 17-19, 3762 EG Soest,
Postbus 465, 3760 AL Soest, Holland
Tel :02155-16544 Fax:02155-17324

ASIA, AFRICA, OCEANIA

HITACHI SALES (MALAYSIA) SDN. BHD.
Wisma Hitachi, No.2, Loronge 13/6A, 46200
Petaling Jaya, Selangor, Malaysia
Tel :03-7573455 Fax:03-7556090

HITACHI (SINGAPORE) PTE. LTD.
PSA Warehousing Services Alexandra Distripark
Block 1, #01-03, Pasir Panjang Road
Singapore 0511
Tel :2787177 Fax:2734450

HITACHI SALES (THAILAND) LTD.
2240-46, New Petchburi Road, Bankapi,
Hueykuang Bangkok, Thailand
Tel :2-314-2741 Fax:2-319-2460

HITACHI ELECTRIC SERVICE CO., (HONG KONG) LTD.
3rd Floor Leun Tai Industrial Bldg., 72-76
Kwai Cheong Road Kwai Chung N.T.,
Hong Kong
Tel :420-4101, 424-0126 Fax:480-4493

Hitachi Sales Corporation of Taiwan
Room A, 11F1. No.180, Sec. 4 Chung Hsiao
E. Road, Taipei Taiwan, R. O. C.
Tel :02-721-6686 Fax:02-752-3211

HITACHI PRODUCTIONS MAROC ELECTRONIQUES DOMESTIQUES S.A
Rue du Havre, Casablanca, Morocco
Tel :212-2-30-73-68, 212-2-30-73-57
Fax:212-2-31-67-42

HITACHI CANARIAS S.A.
Calle San-Francisco No. 19, 38002 Santa Cruz
de Tenerife Canary Islands
Tel :9-22-246498 Fax:9-22-242310

HITACHI SALES AUSTRALIA PTY LTD.
153 Keys Road, Moorabbin, Victoria 3189
Australia
Tel :555-8722 Fax:3-532-1815

VM-4400A(U,C) TK No.3616E,F TOKAI
VM-4450AW,A(PX)
VM-5400A(U,C)

Copyright © Hitachi, Ltd. 1991. All rights reserved.

Printed in Japan (HEC)

VM-4400A(U,C)
VM-4450AW,A(PX)
VM-5400A(U,C)

HITACHI

TK | No.3656E

VM-4400A(U,C)
VM-4450AW,A(PX)
VM-5400A(U,C)

SERVICE MANUAL

SUPPLEMENT-II *Technical Data*

This manual shows the information on changes to the VM-4400A/4450A/5400A .
Use this togerther with the following manuals issued previously .

MANUALS RELATED TO THE VM-4400A/4450A

TITLE	MANUAL No.
VM-4400A/4450A Technical Data	3517E
VM-4400A/4450A Technical Information	3518E
VM-RF71A Technical Data	2996E
VM-AC66A/AC67A Technical Data	3598E

MANUALS RELATED TO THE VM-5400A

TITLE	MANUAL No.
VM-5400A Technical Data	3526E
VM-5400A Technical Information	3527E
VM-RF71A Technical Data	2996E
VM-AC66A/AC67A Technical Data	3598E

VHS
This video deck is a VHS type video recorder. For proper operation, only the VHS type cassette must be used.

SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

VIDEO CAMERA/RECORDER

September 1992 TOKAI Consumer Electronics Division

CONTENTS

CHAPTER 1

LIST OF CORRECTIONS TO SCHEMATIC DIAGRAMS
1. VM-5400A
(1) AUDIO Schematic Diagram 1-1
(2) SYSTEM CONTROL Schematic Diagram 1-1
(3) LUMA/CHROMA Schematic Diagram 1-2
(4) TITLE Schematic Diagram 1-3
2. VM-4400A
(1) TROUBUL SENSOR Schematic Diagram 1-5
(2) AUDIO Schematic Diagram 1-5
(3) SYSTEM CONTOROL Schematic Diagram 1-5
(4) LUMA/CHROMA Schematic Diagram 1-6
3. VM4450A(PX)/VM-4450AW
(1) SYSTEM CONTOROL Schematic Diagram 1-7

CHAPTER 2

LIST OF CHANGES TO SCHEMATIC DIAGRAMS
1. TROUBLE SENSOR Schematic Diagram 2-1
2. AUDIO Schematic Diagram 2-1
3. SWITCHING REGULATOR Schematic Diagram 2-3
4. SYSTEM CONTROL Schematic Diagram 2-4
5. SERVO Schematic Diagram 2-6
6. PRE AMP Schematic Diagram 2-7
7. LUMA/CHROMA Schematic Diagram 2-9

CHAPTER 3

SCHEMATIC/CIRCUIT BOARD DIAGRAM
Schematic Diagram
1. VM-5400
(1) AUDIO 3-1
(2) SYSTEM CONTROL 3-3
(3) SERVO 3-5
(4) PRE AMP 3-7
(5) TITLE 3-8
(6) LUMA/CHROMA 3-9
2. VM-4400/VM-4450A
(1) TROUBLE SENSOR 3-11
(2) PRE AMP 3-12
(3) AUDIO 3-13
(4) SYSTEM CONTROL -4400A- 3-15
(5) SYSTEM CONTROL -4450A- 3-17
(6) SERVO 3-19
(7) LUMA/CHROMA 3-21
Circuit Board Diagram
1. MAIN Circuit Board (VM-5400A) 3-23
2. MAIN Circiut Bcard (VM-4400A/4450A) 3-27

CHAPTER 4

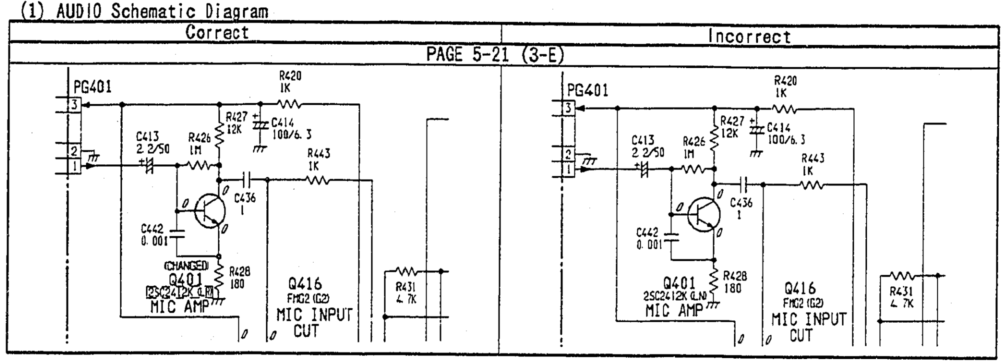
PARTS LIST 4-1

CHAPTER 1

1. VM-5400A

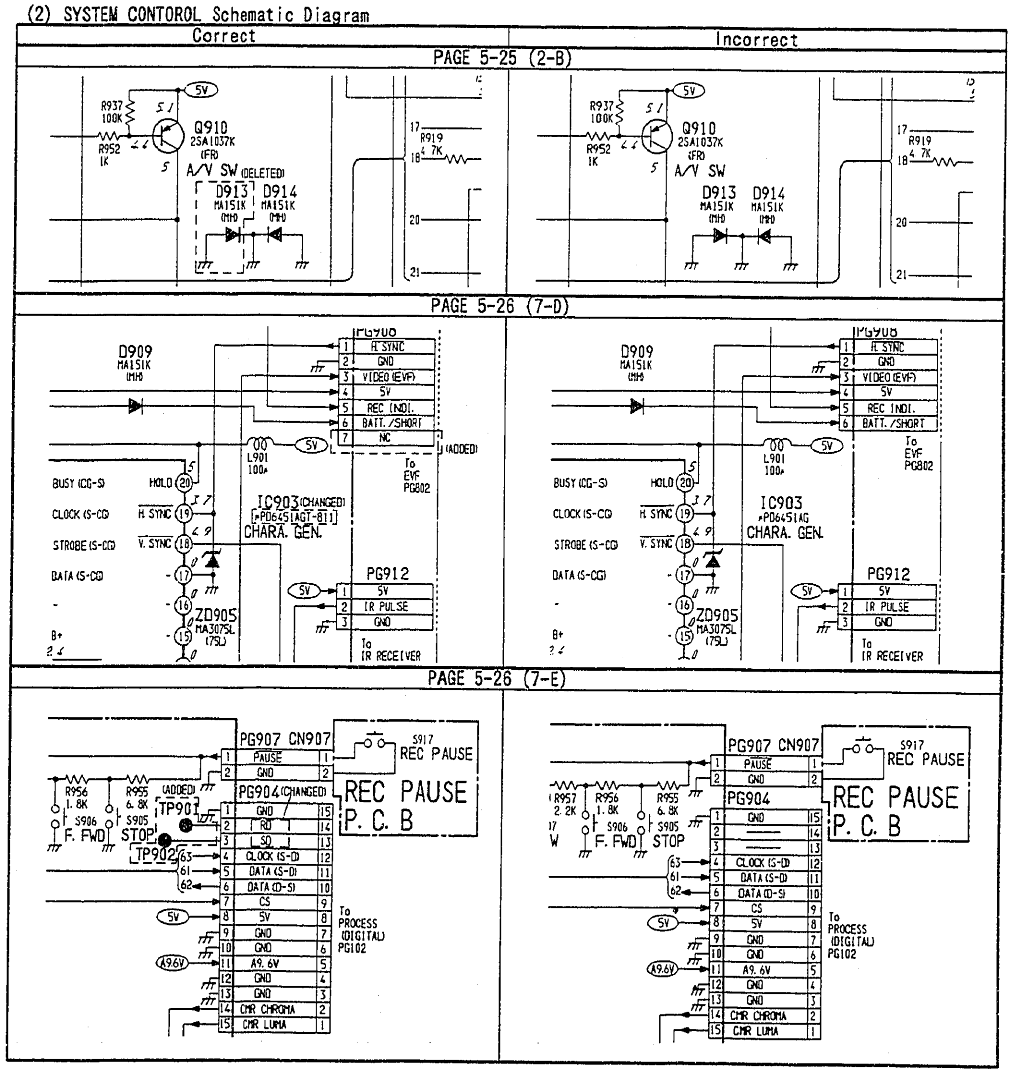
〔There were mistakes in the schematic diagrams of Service Manual (No.3526E). They are corrected as follows.〕

(1) AUDIO Schematic Diagram



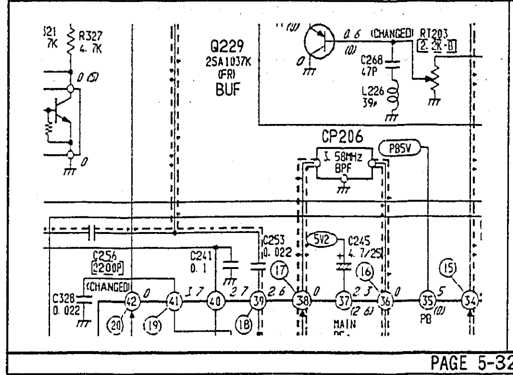
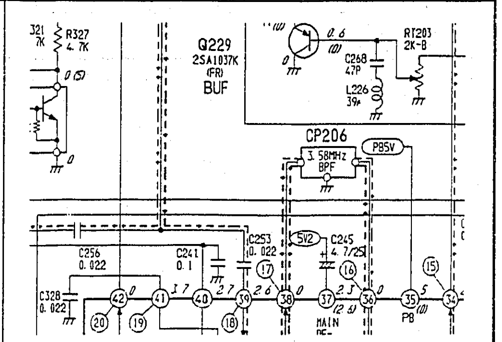
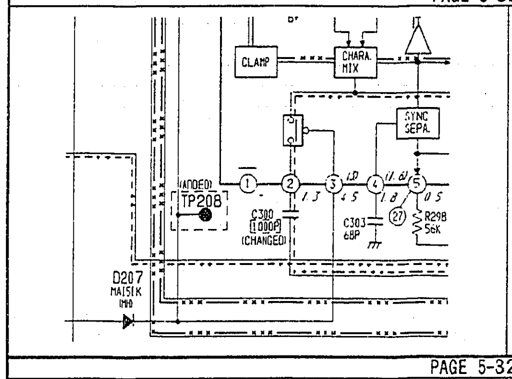
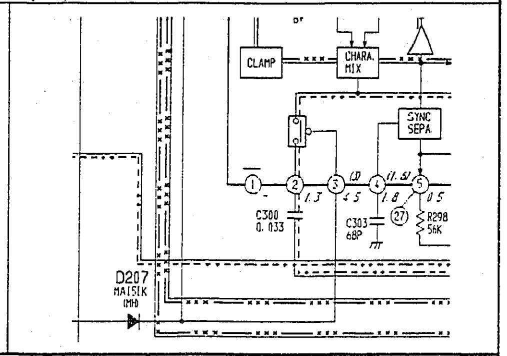
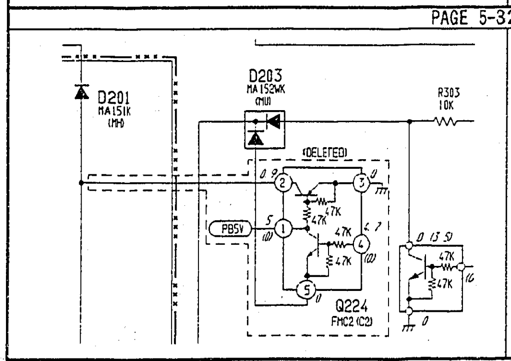
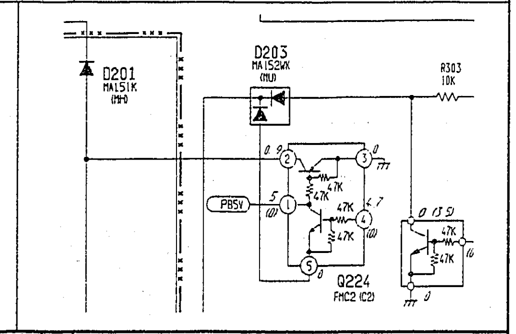
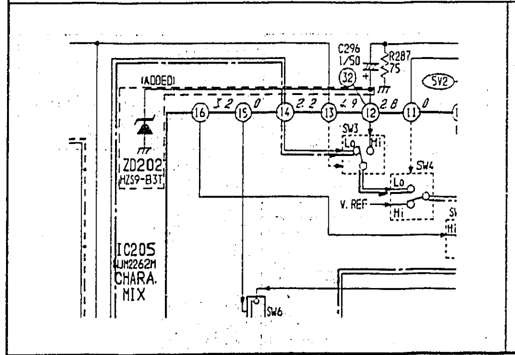
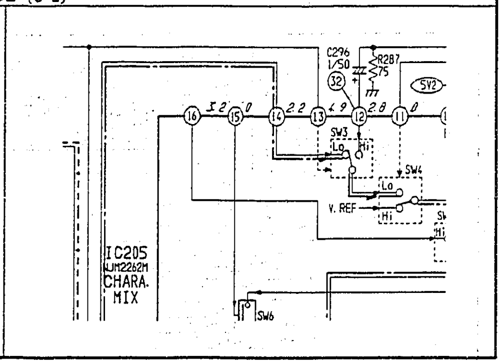
Correct
Incorrect
PAGE 5-21 (3-E)
PG401
R420 1K
R427 12K
C414 100/6.3
C413 2.2/50
R426 1M
R443 1K
C436 1
C442 0.001
(CHANGED)
Q401
2SC2412K (LN)
MIC AMP
R428 180
Q416
FMG2 (G2)
MIC INPUT CUT
R431 4.7K

(2) SYSTEM CONTOROL Schematic Diagram



Correct
Incorrect
PAGE 5-25 (2-B)
5V
R937 100K
R952 1K
Q910
2SA1037K
(FR)
A/V SW
(DELETED)
D913 MA151K (MH)
D914 MA151K (MH)
R919 4.7K
17
18
20
21
PAGE 5-26 (7-D)
D909 MA151K (MH)
PG908
1 H SYNC
2 GND
3 VIDEO (EVF)
4 5V
5 REC INDI.
6 BATT./SHORT
7 NC
(ADDED)
L901 100μ
To EVF PG802
BUSY (CG-S)
CLOCK (S-CG)
STROBE (S-CG)
DATA (S-CG)
B+
HOLD
H. SYNC
V. SYNC
20
19
18
17
16
15
IC903 (CHANGED)
[μPD6451AGT-811]
μPD6451AG
CHARA. GEN.
ZD905
MA3075L
(75L)
PG912
1 5V
2 IR PULSE
3 GND
To IR RECEIVER
PAGE 5-26 (7-E)
PG907 CN907
PAUSE
GND
S917
REC PAUSE
REC PAUSE P.C.B
PG904 (CHANGED)
R956 1.8K
R955 6.8K
R957 2.2K
S906 F. FWD
S905 STOP
(ADDED)
TP901
TP902
1 GND 15
2 RD 14
3 LSD 13
4 CLOCK (S-D) 12
5 DATA (S-D) 11
6 DATA (D-S) 10
7 CS 9
8 5V 8
9 GND 7
10 GND 6
11 A9.6V 5
12 GND 4
13 GND 3
14 CMR CHROMA 2
15 CMR LUMA 1
63
61
62
A9.6V
To PROCESS (DIGITAL) PG102

(3) LUMA/CHROMA Schematic Diagram

Correct	Incorrect
PAGE 5-31 (2-D)	
	
PAGE 5-32 (5-A)	
	
PAGE 5-32 (6-D)	
	
PAGE 5-32 (6-E)	
	

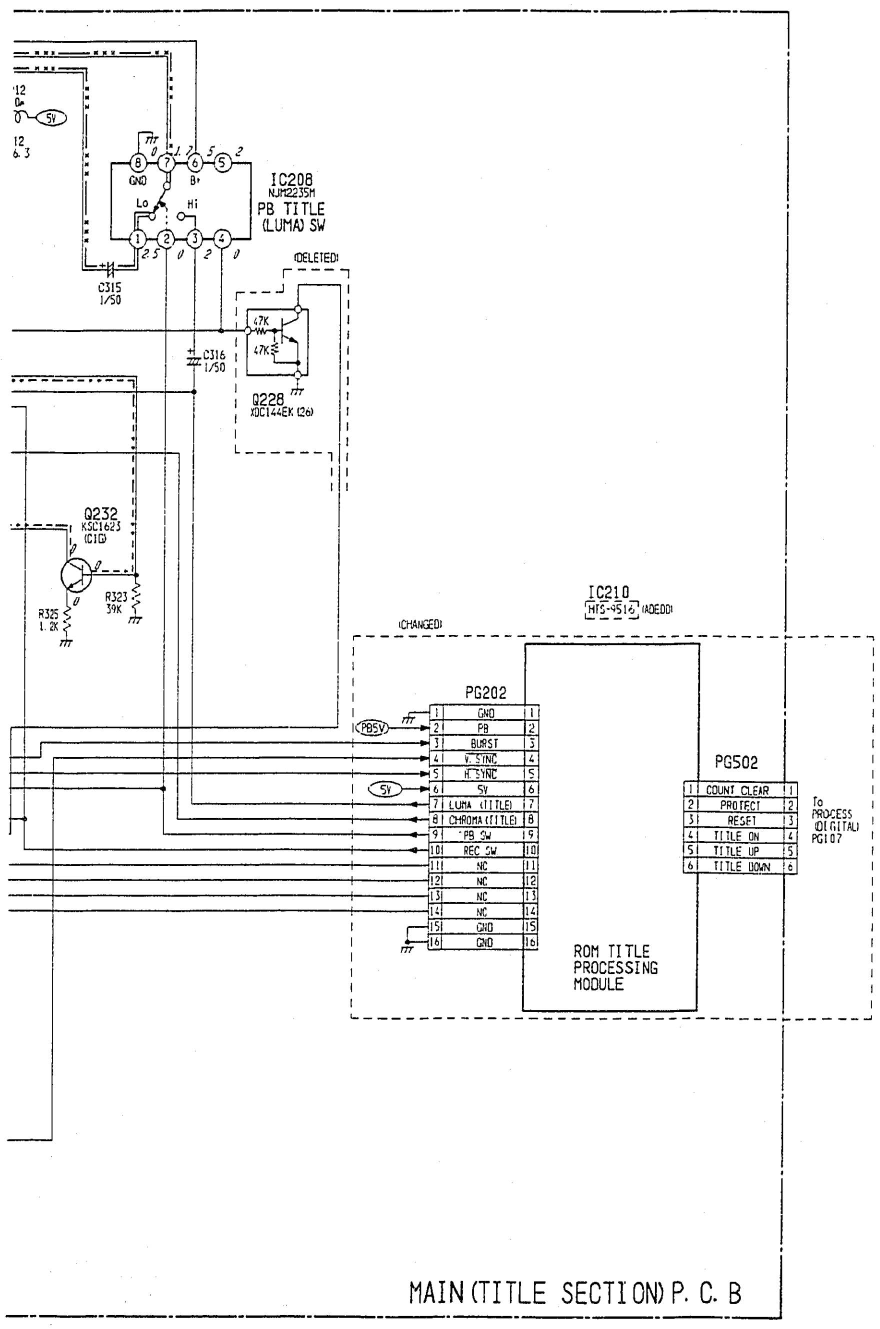
Q229
2SA1037K
(FR)
BUF
(CHANGED) RT203
2K-B
C268
47P
L226
39μ
CP206
3.58MHz
BPF
PB5V
5V2
C256
2200P
(CHANGED)
C328
0.022
C241
0.1
C253
0.022
C245
4.7/25
MAIN
PB
CLAMP
CHARA.
MIX
SYNC
SEPA.
(ADDED)
TP208
C380
1000P
(CHANGED)
C303
68P
R298
56K
D207
MA151K
D201
MA151K
D203
MA152WK
R303
10K
(DELETED)
Q224
FMC2 (C2)
47K
C296
1/50
R287
75
(ADDED)
SW3
Lo
Hi
SW4
V. REF
ZD202
HZS9-B3
IC205
NJM2262M
CHARA.
MIX
SW6

Q229
2SA1037K
(FR)
BUF
RT203
2K-B
C268
47P
L226
39μ
CP206
3.58MHz
BPF
PB5V
5V2
C256
0.022
C241
0.1
C253
0.022
C245
4.7/25
C328
0.022
MAIN
PB
CLAMP
CHARA.
MIX
SYNC
SEPA.
C380
0.033
C303
68P
R298
56K
D207
MA151K
D201
MA151K
D203
MA152WK
R303
10K
Q224
FMC2 (C2)
47K
C296
1/50
R287
75
SW3
Lo
Hi
SW4
V. REF
IC205
NJM2262M
CHARA.
MIX
SW6

(4) TITLE Schematic Diagram

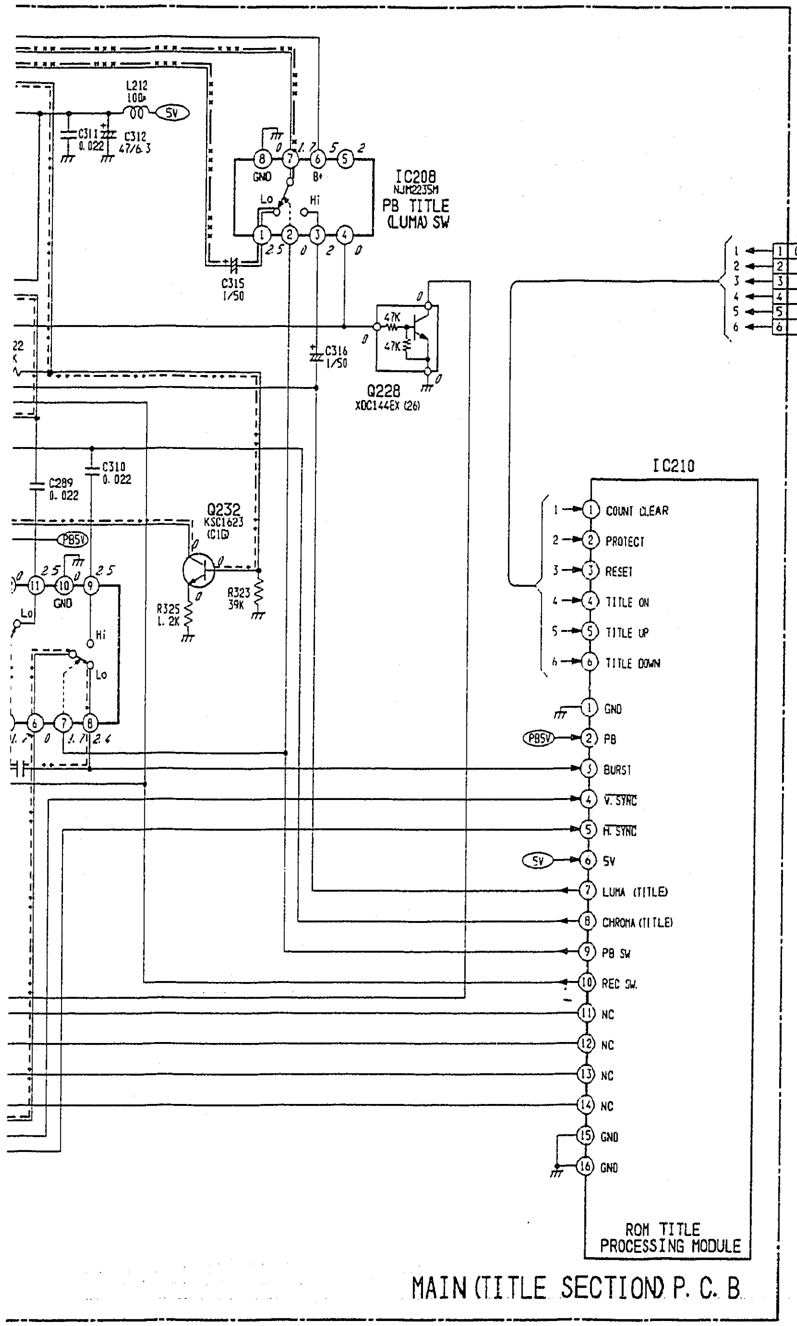
Correct

PAGE 5-33 (3-D)


5V
IC208
NJM2235M
PB TITLE
(LUMA) SW
GND
B+
Lo
Hi
C315
1/50
(DELETED)
C316
1/50
Q228
XDC144EK (26)
47K
Q232
KSC1623
(C1G)
R323
39K
R325
1.2K
IC210
HTS-9516
(ADDED)
(CHANGED)
PG202
PB5V
1 GND
2 PB
3 BURST
4 V. SYNC
5 H. SYNC
6 5V
7 LUMA (TITLE)
8 CHROMA (TITLE)
9 PB SW
10 REC SW
11 NC
12 NC
13 NC
14 NC
15 GND
16 GND
PG502
1 COUNT CLEAR
2 PROTECT
3 RESET
4 TITLE ON
5 TITLE UP
6 TITLE DOWN
To PROCESS (DIGITAL) PG107
ROM TITLE
PROCESSING
MODULE
MAIN (TITLE SECTION) P. C. B

Incorrect

PAGE 5-33 (3-D)



L212
100μ
5V
C311 0.022
C312 47/6.3
IC208
NJM2235M
PB TITLE (LUMA) SW
GND
B+
Lo
Hi
C315 1/50
C316 1/50
Q228
XDC144EX (26)
47K
PG502
1 COUNT CLEAR
2 PROTECT
3 RESET
4 TITLE ON
5 TITLE UP
6 TITLE DOWN
To PROCESS (DIGITAL) PG107
C289 0.022
C310 0.022
Q232
KSC1623 (C10)
P85V
R325 1.2K
R323 39K
IC210
COUNT CLEAR
PROTECT
RESET
TITLE ON
TITLE UP
TITLE DOWN
GND
PB
BURST
V. SYNC
H. SYNC
5V
LUMA (TITLE)
CHROMA (TITLE)
PB SW
REC SW.
NC
NC
NC
NC
GND
GND
ROM TITLE PROCESSING MODULE
MAIN (TITLE SECTION) P. C. B

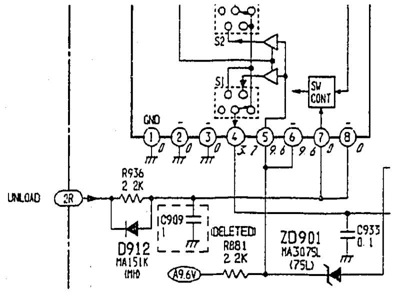
2. VM-4400A

[There were mistakes in the schematic diagrams of Service Manual (No.3517E). They are corrected as follows.]

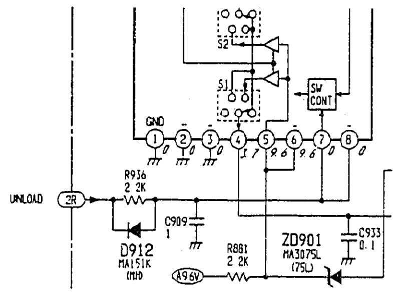
(1) TROUBLE SNSOR Schematic Diagarm

Correct | Incorrect

PAGE 5-20 (6-E)

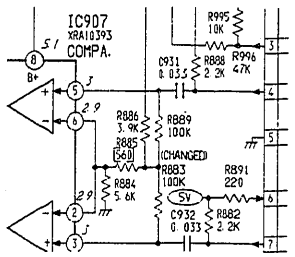


S2
S1
SW CONT
GND
UNLOAD
2R
R936 2.2K
IC909
(DELETED)
D912
MA151K (MD)
R881 2.2K
ZD901
MA3075L (75L)
C933 0.1
A9.6V

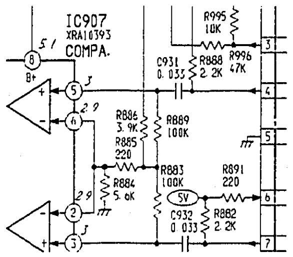


S2
S1
SW CONT
GND
UNLOAD
2R
R936 2.2K
C909 1
D912
MA151K (MD)
R881 2.2K
ZD901
MA3075L (75L)
C933 0.1
A9.6V

PAGE 5-20 (6-C)



IC907
XRA10393
COMPA.
B+
R995 10K
C931 0.033
R888 2.2K
R996 47K
R886 3.9K
R889 100K
R885 560
(CHANGED)
R883 100K
R884 5.6K
R891 220
5V
C932 0.033
R882 2.2K

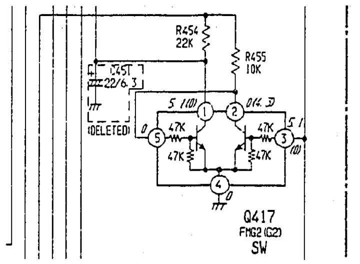


IC907
XRA10393
COMPA.
B+
R995 10K
C931 0.033
R888 2.2K
R996 47K
R886 3.9K
R889 100K
R885 220
R883 100K
R884 5.6K
R891 220
5V
C932 0.033
R882 2.2K

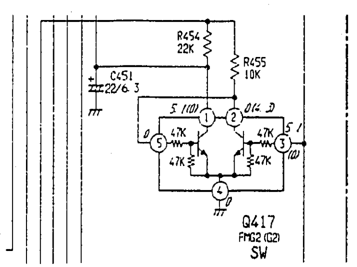
(2) AUDIO Schematic Diagram

Correct | Incorrect

PAGE 5-22 (6-D)



R454 22K
R455 10K
C451 22/6.3
(DELETED)
47K
Q417
FMG2 (G2)
SW

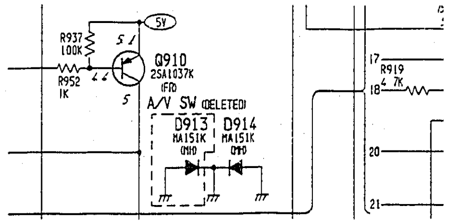


R454 22K
R455 10K
C451 22/6.3
47K
Q417
FMG2 (G2)
SW

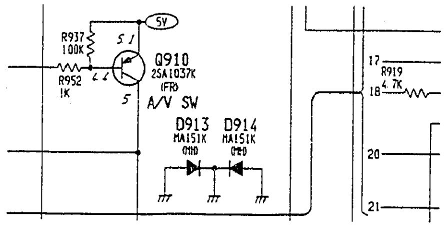
(3) SYSTEM CONTROOL Schematic Diagram

Correct | Incorrect

PAGE 5-25 (2-B)



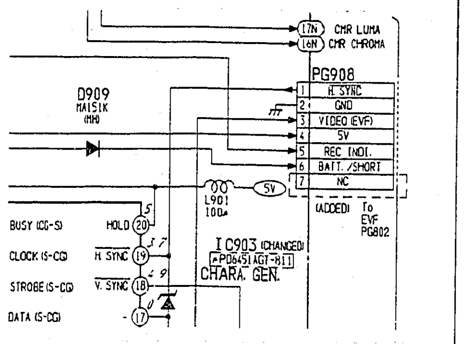
5V
R937 100K
R952 1K
Q910
2SA1037K (FR)
A/V SW (DELETED)
D913
D914
MA151K (MD)
MA151K (MD)
R919 4.7K
17
18
20
21

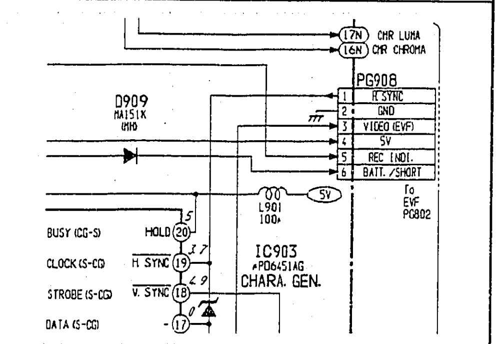


5V
R937 100K
R952 1K
Q910
2SA1037K (FR)
A/V SW
D913
D914
MA151K (MD)
MA151K (MD)
R919 4.7K
17
18
20
21

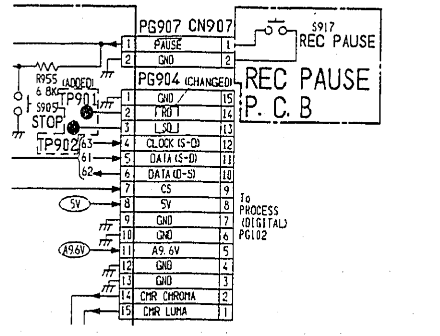
Correct | Incorrect

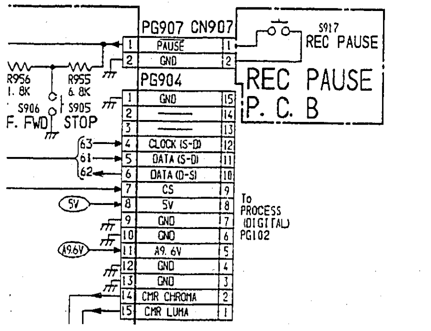
PAGE 5-26 (7-D)


17N CMR LUMA
16N CMR CHROMA
PG908
D909
MA151K
1 H SYNC
2 GND
3 VIDEO (EVF)
4 5V
5 REC INDI.
6 BATT. /SHORT
7 NC
(ADDED)
To EVF PG802
5V
L901 100μ
BUSY (CG-S)
HOLD 20
CLOCK (S-CG)
H SYNC 19
STROBE (S-CG)
V. SYNC 18
DATA (S-CG)
17
IC903 (CHANGED)
μPD6451AGT-B11
CHARA. GEN.


17N CMR LUMA
16N CMR CHROMA
PG908
D909
MA151K
1 H SYNC
2 GND
3 VIDEO (EVF)
4 5V
5 REC INDI.
6 BATT. /SHORT
To EVF PG802
5V
L901 100μ
BUSY (CG-S)
HOLD 20
CLOCK (S-CG)
H SYNC 19
STROBE (S-CG)
V. SYNC 18
DATA (S-CG)
17
IC903
μPD6451AG
CHARA. GEN.

PAGE 5-26 (7-E)

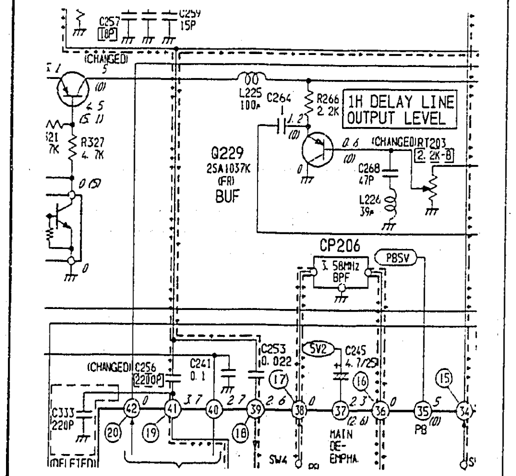

PG907 CN907
S917
REC PAUSE
1 PAUSE
2 GND
PG904 (CHANGED)
REC PAUSE P. C. B
R955 (ADDED) 6.8K
S905 STOP
TP901
TP902
GND
FWD
L SOL
CLOCK (S-D)
DATA (S-D)
DATA (D-S)
CS
5V
GND
A9.6V
CMR CHROMA
CMR LUMA
63
61
62
5V
A9.6V
To PROCESS (DIGITAL) PG102

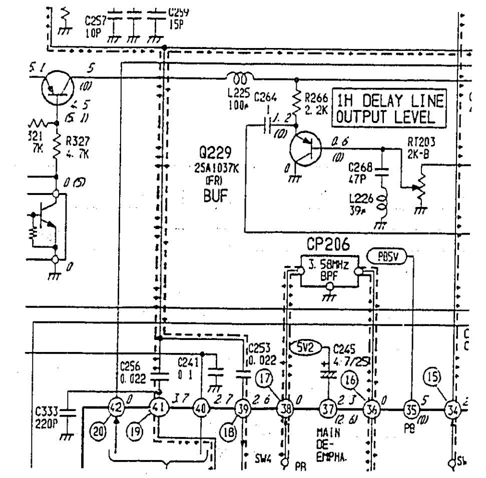

PG907 CN907
S917
REC PAUSE
1 PAUSE
2 GND
PG904
REC PAUSE P. C. B
R956 1.8K
R955 6.8K
S906 F. FWD
S905 STOP
GND
CLOCK (S-D)
DATA (S-D)
DATA (D-S)
CS
5V
GND
A9.6V
CMR CHROMA
CMR LUMA
63
61
62
5V
A9.6V
To PROCESS (DIGITAL) PG102

(4) LUMA/CHROMA Schematic Diagram

Correct | Incorrect

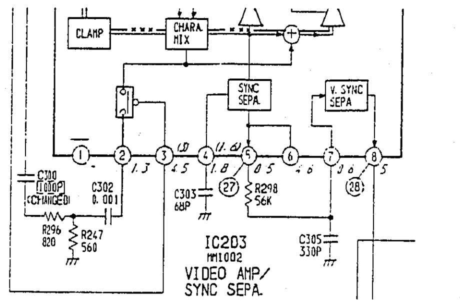
PAGE 5-33 (2-E)

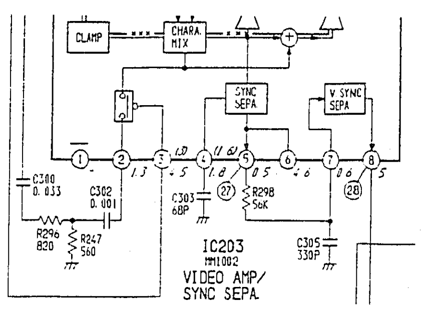

C257 10P
C259 15P
(CHANGED)
L225 100μ
C264
R266 2.2K
1H DELAY LINE OUTPUT LEVEL
(CHANGED) RT203 2.2K-B
Q229
2SA1037K (FR)
BUF
R321 7K
R327 4.7K
C268 47P
L226 39μ
CP206
3.58MHz BPF
PB5V
(CHANGED) C256 2200P
C241 0.1
C253 0.022
5V2
C245 4.7/25
C333 220P
(DELETED)
MAIN DE-EMPHA.
SW4
PB


C257 10P
C259 15P
L225 100μ
C264
R266 2.2K
1H DELAY LINE OUTPUT LEVEL
RT203 2K-B
Q229
2SA1037K (FR)
BUF
R321 7K
R327 4.7K
C268 47P
L226 39μ
CP206
3.58MHz BPF
PB5V
C256 0.022
C241 0.1
C253 0.022
5V2
C245 4.7/25
C333 220P
MAIN DE-EMPHA.
SW4
PB

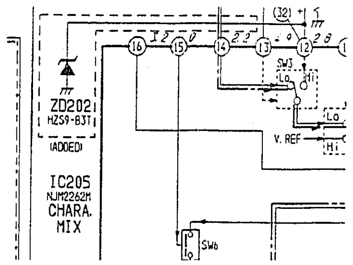
Correct | Incorrect

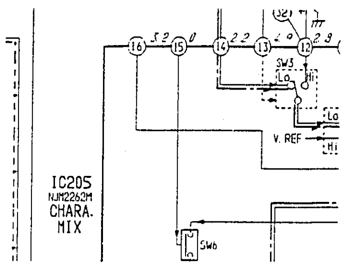
PAGE 5-34 (6-A)


CLAMP
CHARA. MIX
SYNC SEPA.
V. SYNC SEPA
C310 100P (CHANGED)
C302 0.001
C303 68P
R298 56K
R296 820
R247 560
IC203
MM1002
VIDEO AMP/ SYNC SEPA.
C305 330P


CLAMP
CHARA. MIX
SYNC SEPA
V SYNC SEPA
C300 0.033
C302 0.001
C303 68P
R298 56K
R296 820
R247 560
IC203
MM1002
VIDEO AMP/ SYNC SEPA.
C305 330P

PAGE 5-34 (6-E)


ZD202
HZS9-B3T
(ADDED)
IC205
NJM2262M
CHARA. MIX
SW3
Lo
Hi
V. REF
SW6


IC205
NJM2262M
CHARA. MIX
SW3
Lo
Hi
V. REF
SW6

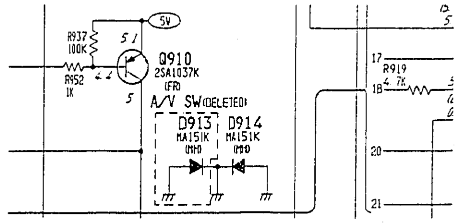
3. VM-4450A(PX)/VM-4450AW

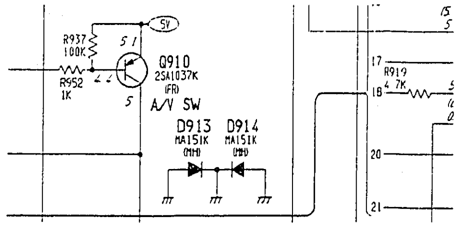
[There were mistakes in the schematic diagrams of Service Manual (No.3517E). They are corrected as follows.]

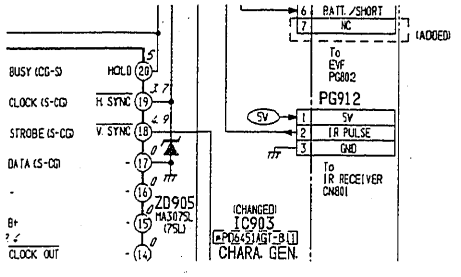
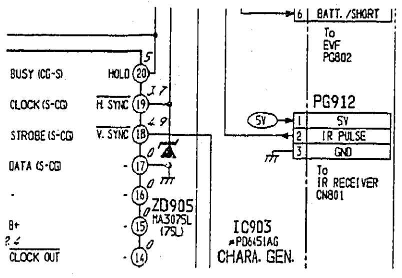
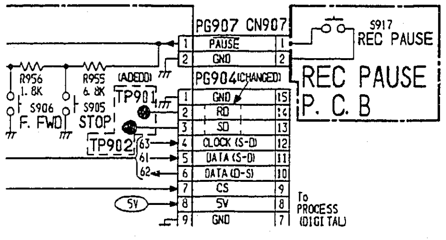
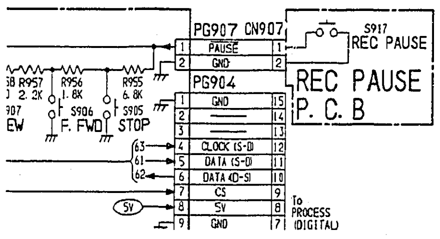
(1) SYSTEM CONTROL Schematic Diagram

Correct | Incorrect

PAGE 5-43 (2-B)


5V
R937 100K
Q910
2SA1037K (FR)
R952 1K
A/V SW (DELETED)
D913 MA151K
D914 MA151K
R919 4.7K
17
18
20
21

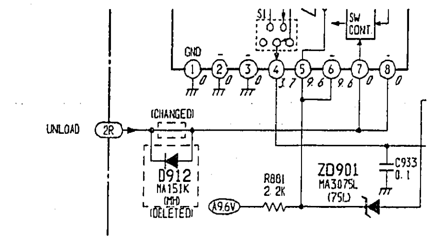
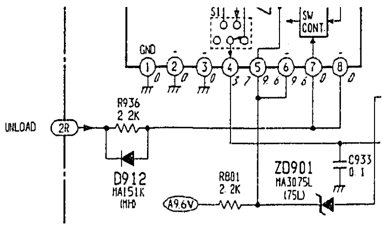

5V
R937 100K
Q910
2SA1037K (FR)
R952 1K
A/V SW
D913 MA151K
D914 MA151K
R919 4.7K
17
18
20
21

Correct	Incorrect
PAGE 5-44 (7-D)	
	
PAGE 5-44 (7-D)	
	

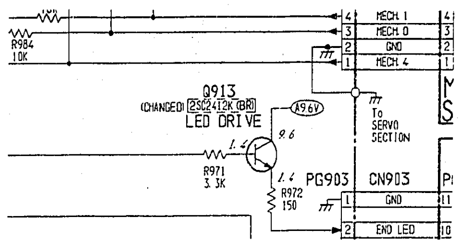
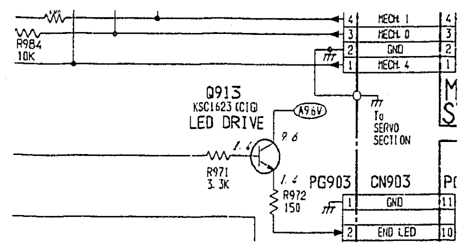
1. TROUBLE SENSOR Schematic Diagram

(Only the changed sections are shown here.)

ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4400A	No.3517E	5-20	XXXX6501 and later
VM-4450A(PX)	No.3517E	5-20	XXXX1501 and later
VM-4450AW	No.3517E	5-20	XXXXX501 and later

After Change	Before Change
VM-4450A(PX) : PAGE 5-20 (5-E)	VM-4450AW : PAGE 5-20 (5-E)
	

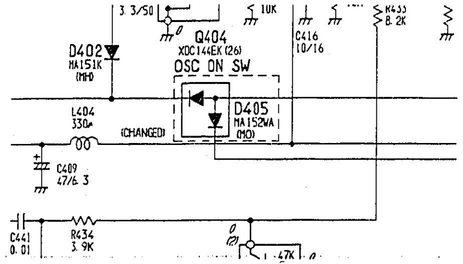
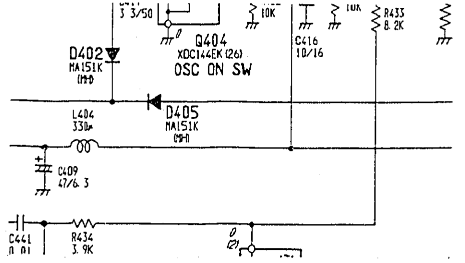
ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4450A(PX)	No.3517E	5-20	XXXX2301 ~ XXXX3300
VM-4450AW	No.3517E	5-20	XXXX1501 ~ XXXX2000

After Change	Before Change
VM-4450A(PX) : PAGE 5-20 (6-C)	VM-4450AW : PAGE 5-20 (6-C)
	

2. AUDIO Schematic Diagram

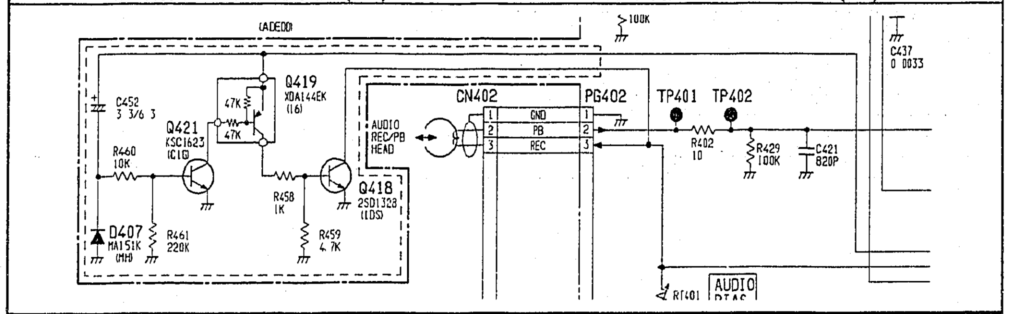
(Only the changed sections are shown here.)

ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-5400A	No.3526E	5-21-5-22	XXXX2501 and later
VM-4400A	No.3517E	5-21-5-22	XXX12501 and later
VM-4450A(PX)	No.3517E	5-21-5-22	XXXX1501 and later
VM-4450AW	No.3517E	5-21-5-22	XXXXX501 and later

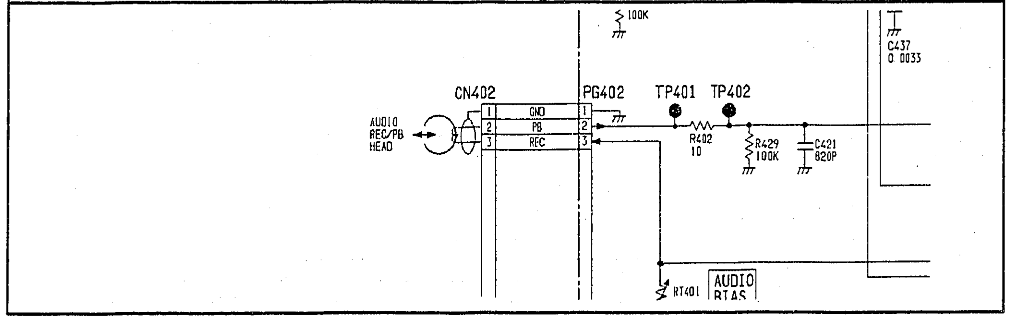
After Change	Before Change
VM-5400A : PAGE 5-21 (4-B) VM-4400A : PAGE 5-21 (4-B)	VM-4450A(PX) : PAGE 5-21 (4-B) VM-4450AW : PAGE 5-21 (4-B)
	

After Change

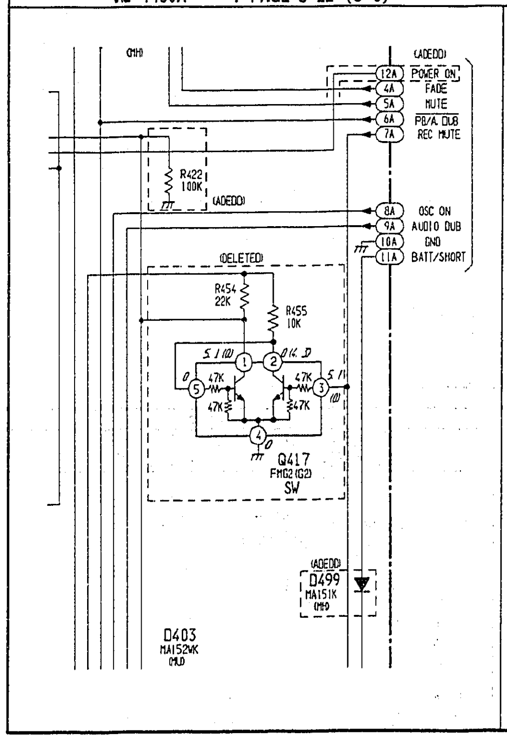
VM-5400A : PAGE 5-21 (2-C) VM-4450A(PX) : PAGE 5-21 (2-C)
VM-4400A : PAGE 5-21 (2-C) VM-4450AW : PAGE 5-21 (2-C)

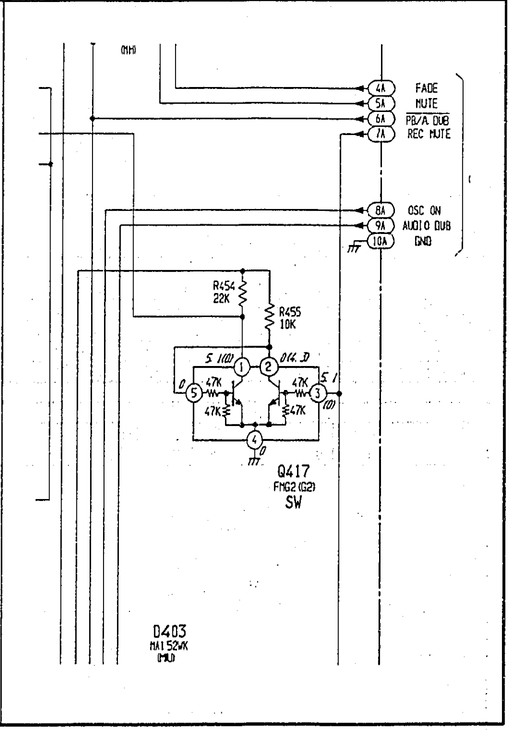

(ADEDD)
100K
C437
0.0033
C452
3.3/6.3
Q419
XDA144EK
(16)
47K
Q421
KSC1623
(C1G)
R460
10K
R458
1K
Q418
2SD1328
(1DS)
D407
MA151K
(MH)
R461
220K
R459
4.7K
CN402
GND
PB
REC
AUDIO
REC/PB
HEAD
PG402
TP401
TP402
R402
10
R429
100K
C421
820P
RT401
AUDIO
BIAS

Before Change


100K
C437
0.0033
CN402
GND
PB
REC
AUDIO
REC/PB
HEAD
PG402
TP401
TP402
R402
10
R429
100K
C421
820P
RT401
AUDIO
BIAS

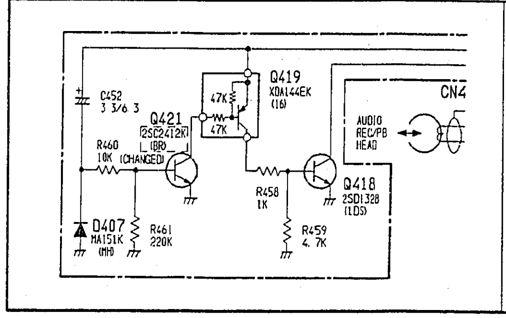
After Change	Before Change
VM-5400A : PAGE 5-22 (6-C) VM-4400A : PAGE 5-22 (6-C)	VM-4450A(PX) : PAGE 5-22 (6-C) VM-4450AW : PAGE 5-22 (6-C)

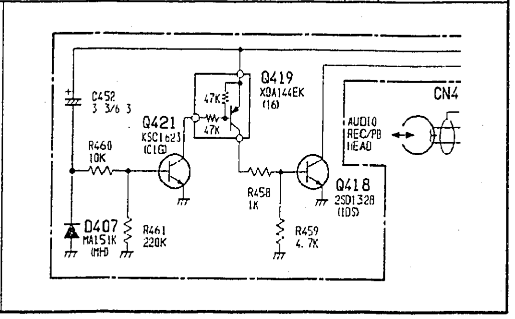

(MH)
(ADEDD)
12A POWER ON
4A FADE
5A MUTE
6A PB/A DUB
7A REC MUTE
R422
100K
(ADEDD)
8A OSC ON
9A AUDIO DUB
10A GND
11A BATT/SHORT
(DELETED)
R454
22K
R455
10K
47K
Q417
FMG2 (G2)
SW
(ADEDD)
D499
MA151K
(MH)
D403
MA152WK
(MU)


(MH)
4A FADE
5A MUTE
6A PB/A DUB
7A REC MUTE
8A OSC ON
9A AUDIO DUB
10A GND
R454
22K
R455
10K
47K
Q417
FMG2 (G2)
SW
D403
MA152WK
(MU)

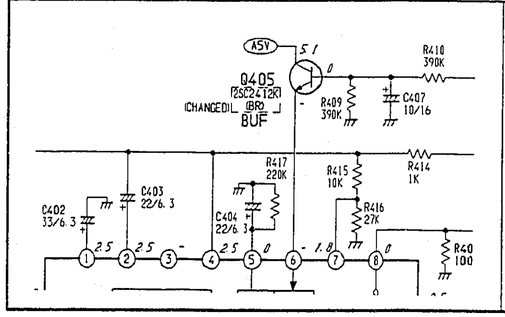
ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4450A(PX)	No.3517E	5-21~5-22	XXXX2301 ~ XXXX3300
VM-4450AW	No.3517E	5-21~5-22	XXXX1501 ~ XXXX2000

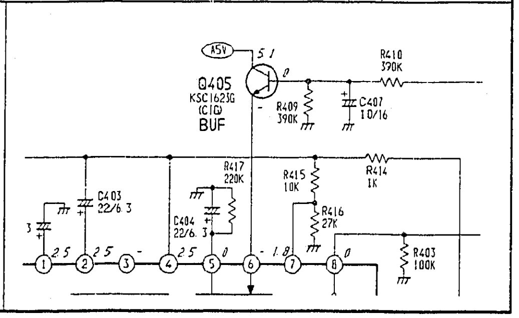
After Change	Before Change
VM-4450A(PX) : PAGE 5-21 (2-C)	VM-4450AW : PAGE 5-21 (2-C)


C452
3.3/6.3
Q419
XDA144EK
(16)
47K
Q421
2SC2412K
(BR)
R460
10K
(CHANGED)
CN4
AUDIO
REC/PB
HEAD
R458
1K
Q418
2SD1328
(1DS)
D407
MA151K
(MH)
R461
220K
R459
4.7K


C452
3.3/6.3
Q419
XDA144EK
(16)
47K
Q421
KSC1623
(C1G)
R460
10K
CN4
AUDIO
REC/PB
HEAD
R458
1K
Q418
2SD1328
(1DS)
D407
MA151K
(MH)
R461
220K
R459
4.7K

After Change	Before Change
VM-4450A(PX) : PAGE 5-22 (5-E)	VM-4450AW : PAGE 5-22 (5-E)


A5V
Q405
2SC2412K
(CHANGED)
(BR)
BUF
R410
390K
R409
390K
C407
10/16
R417
220K
R415
10K
R414
1K
R416
27K
C402
33/6.3
C403
22/6.3
C404
22/6.3
R40
100

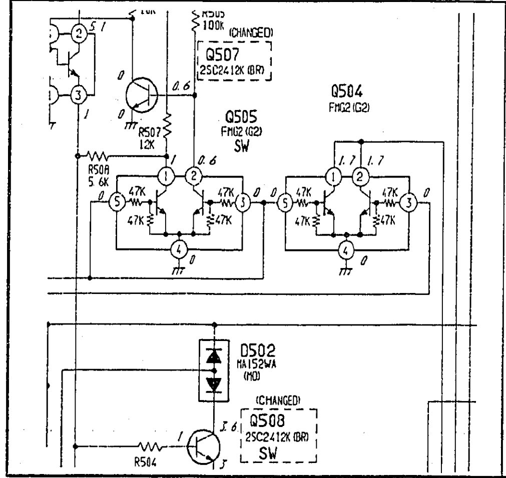

A5V
Q405
KSC1623G
(C1G)
BUF
R410
390K
R409
390K
C407
10/16
R417
220K
R415
10K
R414
1K
R416
27K
C403
22/6.3
C404
22/6.3
R403
100K

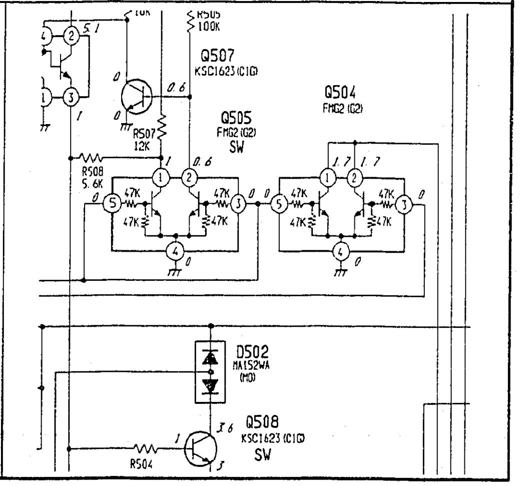
3. SWITCHING REGULATOR Schematic Diagram

(Only the changed sections are shown here.)

ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4450A(PX)	No.3517E	5-23~5-24	XXXX2301 ~ XXXX3300
VM-4450AW	No.3517E	5-23~5-24	XXXX1501 ~ XXXX2000

After Change	Before Change
VM-4450A(PX) : PAGE 5-23 (3-D)	VM-4450AW : PAGE 5-23 (3-D)


R505
100K
(CHANGED)
Q507
2SC2412K (BR)
Q504
FMG2 (G2)
Q505
FMG2 (G2)
SW
R507
12K
R508
5.6K
47K
D502
MA152WA
(MD)
(CHANGED)
Q508
2SC2412K (BR)
SW
R504


R505
100K
Q507
KSC1623 (C1G)
Q504
FMG2 (G2)
Q505
FMG2 (G2)
SW
R507
12K
R508
5.6K
47K
D502
MA152WA
(MD)
Q508
KSC1623 (C1G)
SW
R504

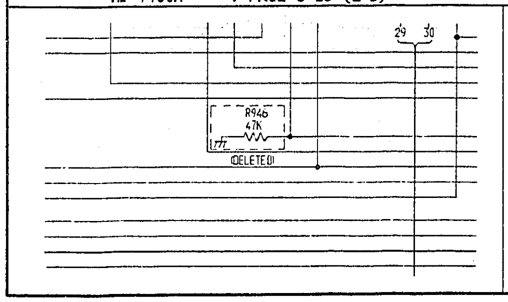
4. SYSTEM CONTROL Schematic Diagram
(Only the changed sections are shown here.)

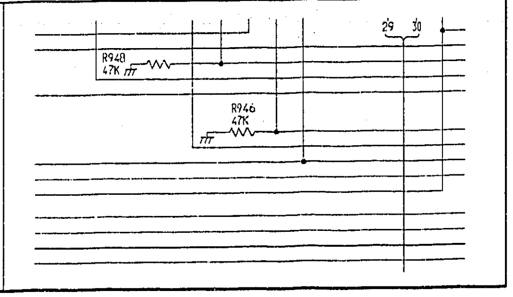
HISTORY OF CHANGES TO IC901's PART NUMBERS

MODEL'S NAMES	Units With Serial No. NAMES of IC901			
VM-5400A	1～XXXX2500 HD404439A37H	XXXX2501 and later HD404439A38H		
VM-4400A	1～XXX10000 HD4074719H(7.5B)	XXX10001～XXX12225 HD407419H(7.5C)	XXX12226～XXX16000 HD404439A37H	XXX16001 and later HD404439A38H
VM-4450A(PX)	1～XXXX1500 HD4074719H	XXXX1501～XXXX2000 HD404439A37H	XXXX2001 and later HD404439A38H	
VM-4450AW	1～XXXXX500 HD4074719H	XXXXX501～XXXXX900 HD404439A37H	XXXXX901 and later HD404439A38H	

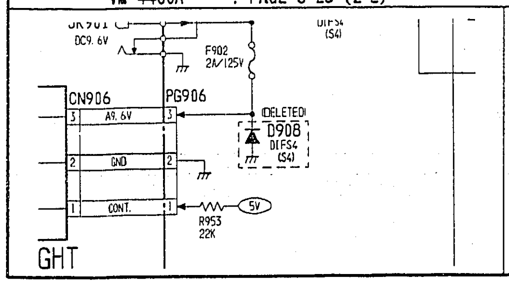
ITEM MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-5400A	No.3526E	5-25~5-26	XXXX2501 and later
VM-4400A	No.3517E	5-25~5-26	XXX12501 and later
VM-4450A(PX)	No.3517E	5-43~5-44	XXXX1501 and later
VM-4450AW	No.3517E	5-43~5-44	XXXXX501 and later

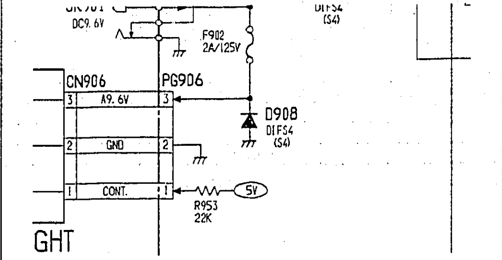
After Change	Before Change
VM-5400A : PAGE 5-25 (2-B) VM-4400A : PAGE 5-25 (2-B)	VM-4450A(PX) : PAGE 5-43 (2-B) VM-4450AW : PAGE 5-43 (2-B)


29
30
R946
47K
(DELETED)

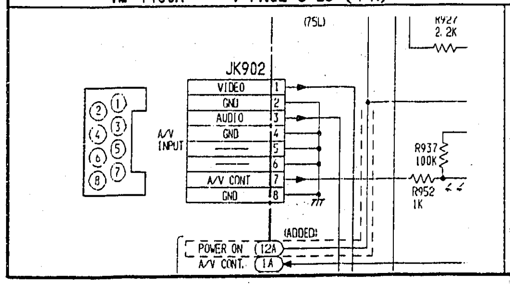

29
30
R940
47K
R946
47K

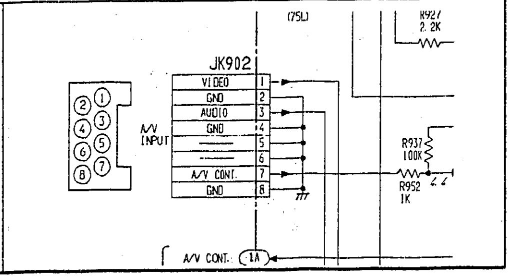
After Change	Before Change
VM-5400A : PAGE 5-25 (2-E) VM-4400A : PAGE 5-25 (2-E)	VM-4450A(PX) : PAGE 5-43 (2-E) VM-4450AW : PAGE 5-43 (2-E)


DC9.6V
F902
2A/125V
CN906
PG906
A9.6V
GND
CONT.
(DELETED)
D908
D1FS4
(S4)
R953
22K
5V
GHT

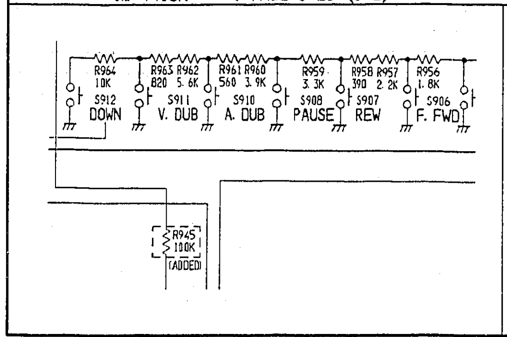

DC9.6V
F902
2A/125V
CN906
PG906
A9.6V
GND
CONT.
D908
D1FS4
(S4)
R953
22K
5V
GHT

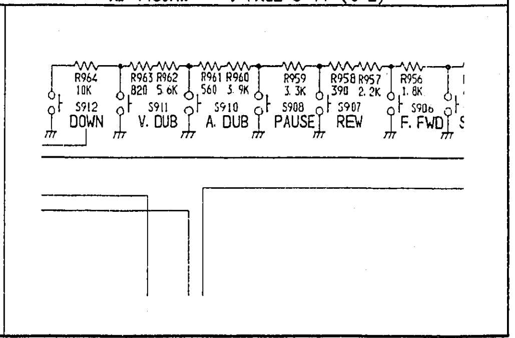
After Change	Before Change
VM-5400A : PAGE 5-25 (4-A) VM-4400A : PAGE 5-25 (4-A)	VM-4450A(PX) : PAGE 5-43 (4-A) VM-4450AW : PAGE 5-43 (4-A)


(75Ω)
R927
2.2K
JK902
VIDEO
GND
AUDIO
GND
A/V CONT
GND
A/V INPUT
R937
100K
R952
1K
(ADDED)
POWER ON
12A
A/V CONT.
1A

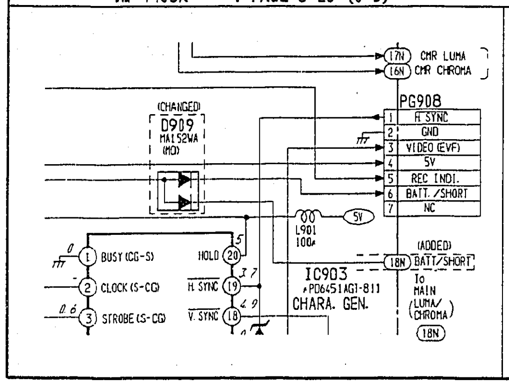

(75Ω)
R927
2.2K
JK902
VIDEO
GND
AUDIO
GND
A/V CONT.
GND
A/V INPUT
R937
100K
R952
1K
A/V CONT.
1A

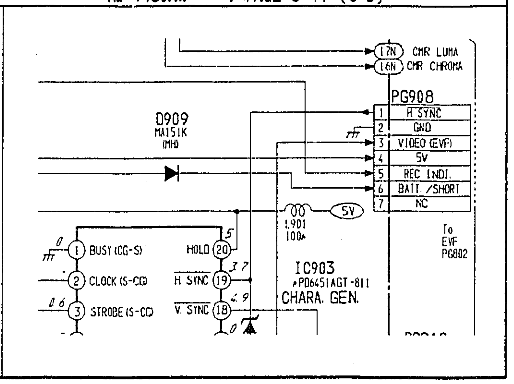
After Change	Before Change
VM-5400A : PAGE 5-26 (5-E) VM-4400A : PAGE 5-26 (5-E)	VM-4450A(PX) : PAGE 5-44 (6-E) VM-4450AW : PAGE 5-44 (6-E)


R964
10K
R963
820
R962
5.6K
R961
560
R960
3.9K
R959
3.3K
R958
390
R957
2.2K
R956
1.8K
S912
DOWN
S911
V. DUB
S910
A. DUB
S908
PAUSE
S907
REW
S906
F. FWD
R945
100K
(ADDED)


R964
10K
R963
820
R962
5.6K
R961
560
R960
3.9K
R959
3.3K
R958
390
R957
2.2K
R956
1.8K
S912
DOWN
S911
V. DUB
S910
A. DUB
S908
PAUSE
S907
REW
S906
F. FWD

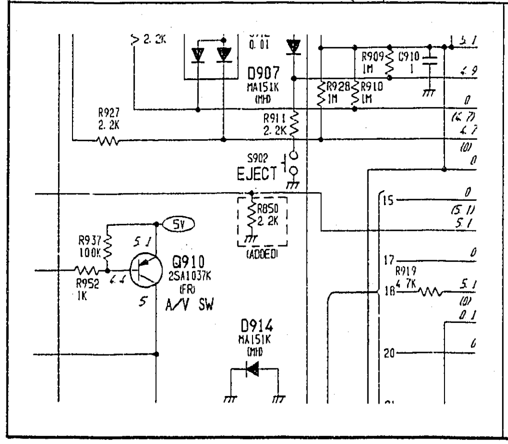
After Change	Before Change
VM-5400A : PAGE 5-26 (6-D) VM-4400A : PAGE 5-26 (6-D)	VM-4450A(PX) : PAGE 5-44 (6-D) VM-4450AW : PAGE 5-44 (6-D)

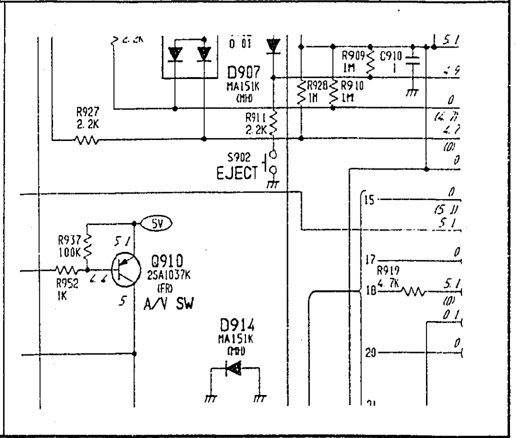

17N
CHR LUMA
16N
CHR CHROMA
(CHANGED)
D909
MA152WA
(MD)
PG908
H SYNC
GND
VIDEO (EVF)
5V
REC INDI.
BATT./SHORT
NC
L901
100μ
5V
(ADDED)
18N
BATT/SHORT
BUSY (CG-S)
CLOCK (S-CG)
STROBE (S-CG)
HOLD
H. SYNC
V. SYNC
IC903
μPD6451AGT-811
CHARA. GEN.
To MAIN
(LUMA/CHROMA)
18N


17N
CHR LUMA
16N
CHR CHROMA
PG908
D909
MA151K
(MD)
H SYNC
GND
VIDEO (EVF)
5V
REC INDI.
BATT./SHORT
NC
L901
100μ
5V
To EVF PG802
BUSY (CG-S)
CLOCK (S-CG)
STROBE (S-CG)
HOLD
H. SYNC
V. SYNC
IC903
μPD6451AGT-811
CHARA. GEN.

ITEM MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-5400A	No.3526E	5-25~5-26	XXXX2501 and later
VM-4400A	No.3517E	5-25~5-26	XXX22501 and later
VM-4450A(PX)	No.3517E	5-43~5-44	XXXX2001 and later
VM-4450AW	No.3517E	5-43~5-44	XXXXX901 and later

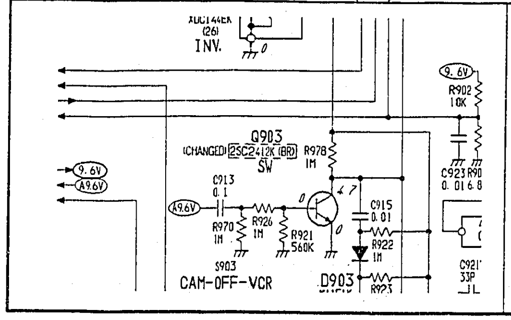
After Change	Before Change
VM-5400A : PAGE 5-25 (3-B) VM-4400A : PAGE 5-25 (3-B)	VM-4450A(PX) : PAGE 5-43 (3-B) VM-4450AW : PAGE 5-43 (3-B)

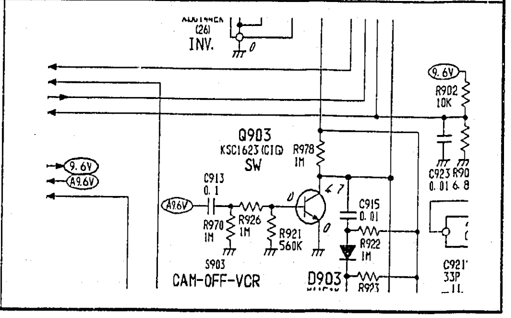

D907
MA151K
(MD)
R909
1M
C910
1
R928
1M
R910
1M
R927
2.2K
R911
2.2K
S902
EJECT
R850
2.2K
(ADDED)
5V
R937
100K
R952
1K
Q910
2SA1037K
(FR)
A/V SW
R919
4.7K
D914
MA151K
(MD)


D907
MA151K
(MD)
R909
1M
C910
1
R928
1M
R910
1M
R927
2.2K
R911
2.2K
S902
EJECT
5V
R937
100K
R952
1K
Q910
2SA1037K
(FR)
A/V SW
R919
4.7K
D914
MA151K
(MD)

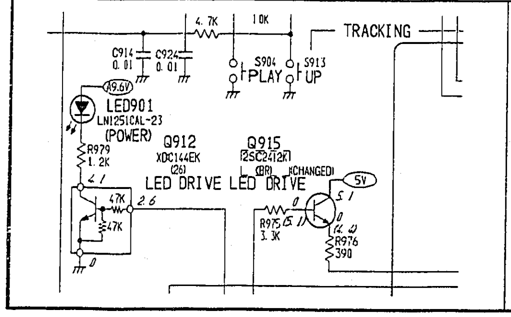
ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4450A(PX)	No.3517E	5-43~5-44	XXXX2301 ~ XXXX3300
VM-4450AW	No.3517E	5-43~5-44	XXXX1501 ~ XXXX2000

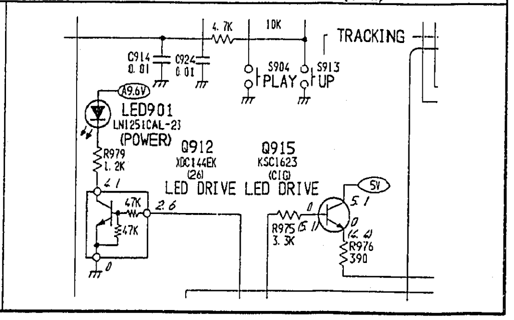
After Change	Before Change
VM-4450A(PX) : PAGE 5-43 (2-C)	VM-4450AW : PAGE 5-43 (2-C)


XDC144EK (26) INV.
9.6V
R902 10K
Q903 (CHANGED) 2SC2412K (BR) SW
R978 1M
C913 0.1
A9.6V
R970 1M
R926 1M
R921 560K
C915 0.01
R922 1M
C923 R90 0.01 6.8
C921 33P
S903 CAM-OFF-VCR
D903


XDC144EK (26) INV.
9.6V
R902 10K
Q903 KSC1623 (C1G) SW
R978 1M
C913 0.1
A9.6V
R970 1M
R926 1M
R921 560K
C915 0.01
R922 1M
C921 33P
S903 CAM-OFF-VCR
D903

After Change	Before Change
VM-4450A(PX) : PAGE 5-44 (5-E)	VM-4450AW : PAGE 5-44 (5-E)


4.7K
10K
TRACKING
C914 0.01
C924 0.01
S904 PLAY
S913 UP
A9.6V
LED901 LN1251CAL-23 (POWER)
R979 1.2K
Q912 XDC144EK (26) LED DRIVE
Q915 2SC2412K (BR) (CHANGED) LED DRIVE
5V
47K
R975 3.3K
R976 390

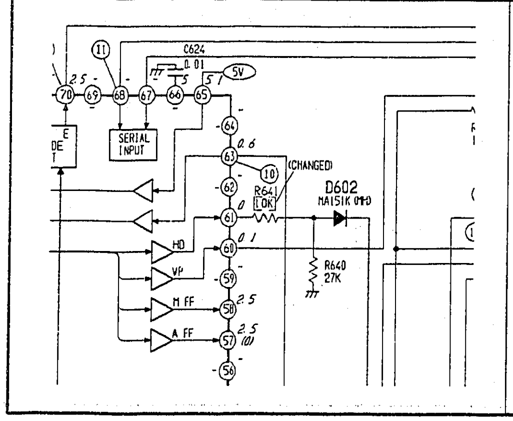

4.7K
10K
TRACKING
C914 0.01
C924 0.01
S904 PLAY
S913 UP
A9.6V
LED901 LN1251CAL-23 (POWER)
R979 1.2K
Q912 XDC144EK (26) LED DRIVE
Q915 KSC1623 (C1G) LED DRIVE
5V
47K
R975 3.3K
R976 390

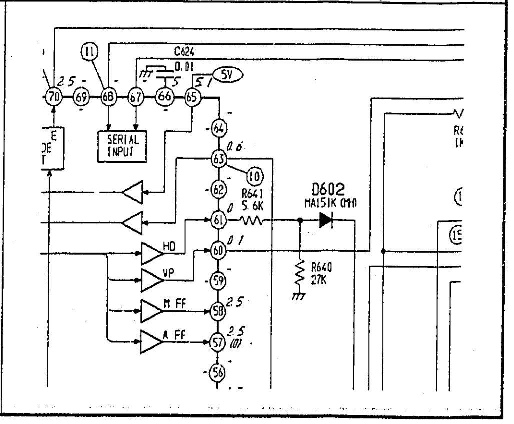
5. SERVO Schematic Diagram

(Only the changed sections are shown here.)

ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-5400A	No.3526E	5-29~5-30	XXXX2501 and later
VM-4400A	No.3517E	5-29~5-30	XXX12501 and later
VM-4450A(PX)	No.3517E	5-29~5-30	XXXX1501 and later
VM-4450AW	No.3517E	5-29~5-30	XXXXX501 and later

After Change	Before Change
VM-5400A : PAGE 5-30 (5-D) VM-4400A : PAGE 5-30 (5-D)	VM-4450A(PX) : PAGE 5-30 (5-D) VM-4450AW : PAGE 5-30 (5-D)


C624 0.01
5V
SERIAL INPUT
(CHANGED)
R641 10K
D602 MA151K (MH)
HD
VP
M FF
A FF
R640 27K

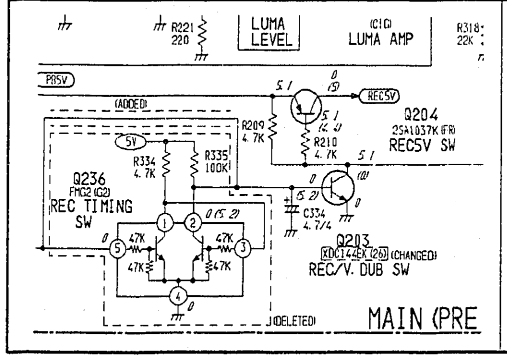

C624 0.01
5V
SERIAL INPUT
R641 5.6K
D602 MA151K (MH)
HD
VP
M FF
A FF
R640 27K

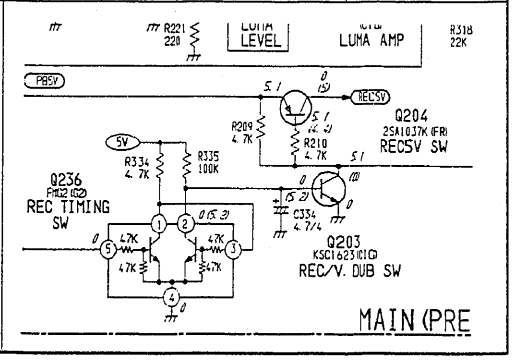
6. PRE AMP Schematic Diagram

(Only the changed sections are shown here.)

ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4400A	No.3517E	5-31	XXXX6501 and later
VM-4450A(PX)	No.3517E	5-31	XXXX1501 and later
VM-4450AW	No.3517E	5-31	XXXXX501 and later

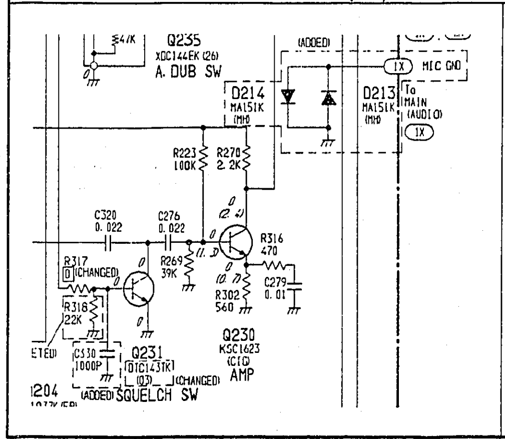
After Change	Before Change
VM-4450A(PX) : PAGE 5-31 (2-A)	VM-4450AW : PAGE 5-31 (2-A)

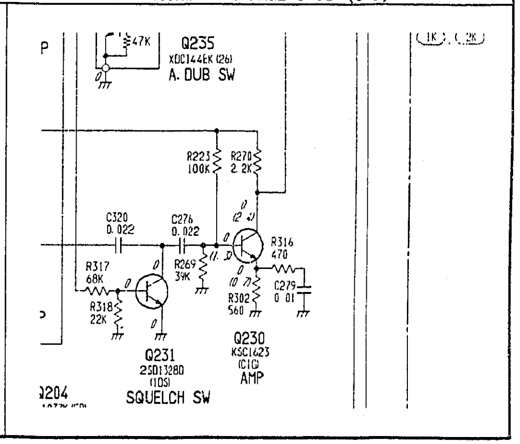

R221 220
LUMA LEVEL
(C1G) LUMA AMP
R318 22K
PB5V
REC5V
(ADDED)
R209 4.7K
Q204 2SA1037K (FR) REC5V SW
5V
R334 4.7K
R335 100K
R210 4.7K
Q236 FM2 (02) REC TIMING SW
C334 4.7/4
47K
Q203 XDC144EK (26) (CHANGED) REC/V. DUB SW
(DELETED)
MAIN (PRE


R221 220
LUMA LEVEL
LUMA AMP
R318 22K
PB5V
REC5V
R209 4.7K
Q204 2SA1037K (FR) REC5V SW
5V
R334 4.7K
R335 100K
R210 4.7K
Q236 FM2 (02) REC TIMING SW
C334 4.7/4
47K
Q203 KSC1623 (C1G) REC/V. DUB SW
MAIN (PRE

ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-5400A	No.3526E	5-34	XXXX2501 and later
VM-4400A	No.3517E	5-31	XXX12501 and later
VM-4450A(PX)	No.3517E	5-31	XXXX1501 and later
VM-4450AW	No.3517E	5-31	XXXXX501 and later

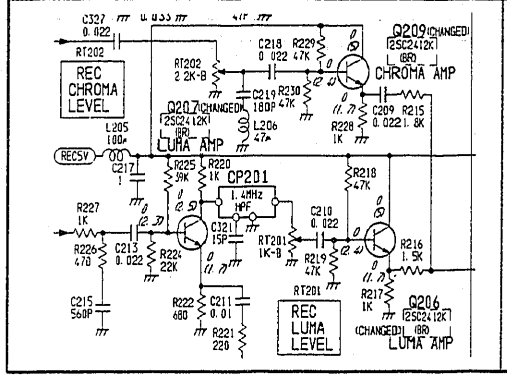
After Change	Before Change
VM-5400A : PAGE 5-34 (3-B) VM-4400A : PAGE 5-31 (3-B)	VM-4450A(PX) : PAGE 5-31 (3-B) VM-4450AW : PAGE 5-31 (3-B)


47K
Q235 XDC144EK (26) A. DUB SW
(ADDED)
MIC (XX)
D214 MA151K (MH)
D213 MA151K (MH)
To MAIN (AUDIO)
R223 100K
R270 2.2K
C320 0.022
C276 0.022
R316 470
R317 (CHANGED)
R269 39K
R302 560
C279 0.01
R318 22K
C530 1000P
Q231 DTC143TK (03) (CHANGED) SQUELCH SW
(ADDED)
Q230 KSC1623 (C1G) AMP

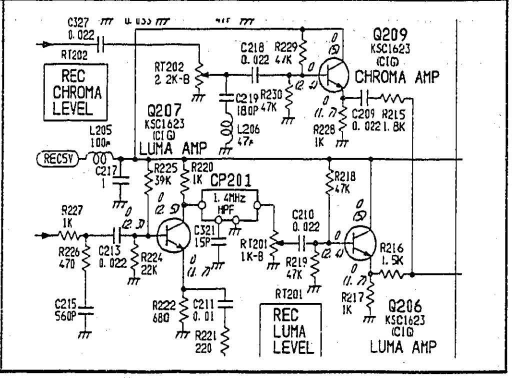

47K
Q235 XDC144EK (26) A. DUB SW
R223 100K
R270 2.2K
C320 0.022
C276 0.022
R316 470
R317 68K
R269 39K
R302 560
C279 0.01
R318 22K
Q231 2SD1328D (10S) SQUELCH SW
Q230 KSC1623 (C1G) AMP

ITEM MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4450A(PX)	No.3517E	5-31	XXXX2301 ~ XXXX3300
VM-4450AW	No.3517E	5-31	XXXX1501 ~ XXXX2000

After Change	Before Change
VM-4450A(PX) : PAGE 5-31 (2-B)	VM-4450AW : PAGE 5-31 (2-B)

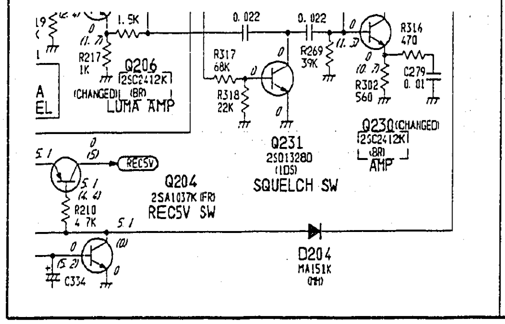


C327
0.022
RT202
REC CHROMA LEVEL
RT202 2.2K-B
C218 0.022
R229 47K
Q209 (CHANGED) (2SC2412K) (BR)
CHROMA AMP
C219 180P
R230 47K
Q207 (CHANGED) (2SC2412K) (BR)
LUMA AMP
L206 47μ
R228 1K
C209 0.022
R215 1.8K
L205 100μ
REC5V
C217
R225 39K
R220 1K
CP201
1.4MHz HPF
R218 47K
R227 1K
C321 15P
RT201 1K-B
C210 0.022
R216 1.5K
R226 470
C213 0.022
R224 22K
R219 47K
RT201
R217 1K
Q206 (CHANGED) (2SC2412K) (BR)
LUMA AMP
C215 560P
R222 680
C211 0.01
R221 220
REC LUMA LEVEL

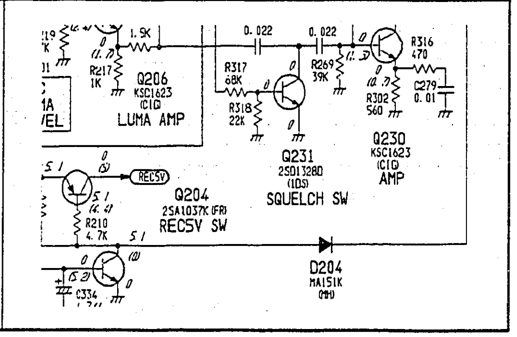


C327
0.022
RT202
REC CHROMA LEVEL
RT202 2.2K-B
C218 0.022
R229 47K
Q209 KSC1623 (C|G)
CHROMA AMP
C219 180P
R230 47K
Q207 KSC1623 (C|G)
LUMA AMP
L206 47μ
R228 1K
C209 0.022
R215 1.8K
L205 100μ
REC5V
C217
R225 39K
R220 1K
CP201
1.4MHz HPF
R218 47K
R227 1K
C321 15P
RT201 1K-B
C210 0.022
R216 1.5K
R226 470
C213 0.022
R224 22K
R219 47K
RT201
R217 1K
Q206 KSC1623 (C|G)
LUMA AMP
C215 560P
R222 680
C211 0.01
R221 220
REC LUMA LEVEL

After Change	Before Change
VM-4450A(PX) : PAGE 5-31 (3-A)	VM-4450AW : PAGE 5-31 (3-A)

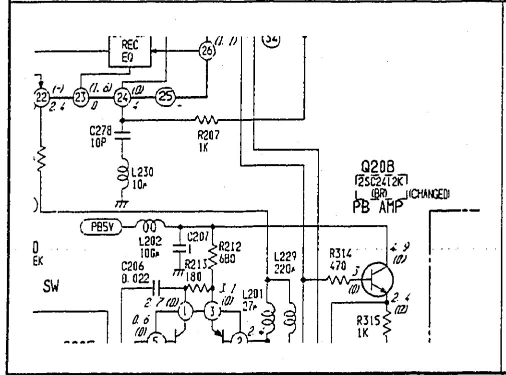


1.5K
0.022
0.022
R316 470
R217 1K
Q206 (2SC2412K) (CHANGED) (BR)
LUMA AMP
R317 68K
R269 39K
C279 0.01
R302 560
R318 22K
Q230 (CHANGED) (2SC2412K) (BR)
AMP
Q231 2SD1328D (IDS)
SQUELCH SW
REC5V
Q204 2SA1037K (FR)
REC5V SW
R210 4.7K
D204 MA151K (MI)
C334

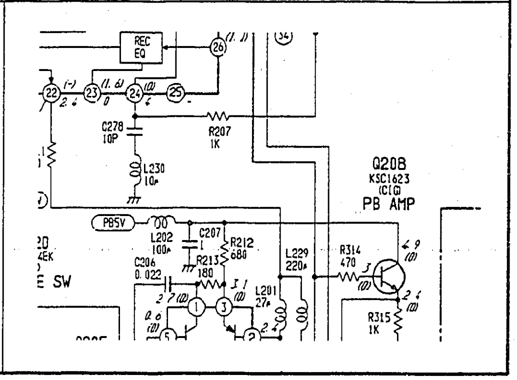


1.5K
0.022
0.022
R316 470
R217 1K
Q206 KSC1623 (C|G)
LUMA AMP
R317 68K
R269 39K
C279 0.01
R302 560
R318 22K
Q230 KSC1623 (C|G)
AMP
Q231 2SD1328D (IDS)
SQUELCH SW
REC5V
Q204 2SA1037K (FR)
REC5V SW
R210 4.7K
D204 MA151K (MI)
C334

After Change	Before Change
VM-4450A(PX) : PAGE 5-31 (3-D)	VM-4450AW : PAGE 5-31 (3-D)



REC EQ
C278 10P
R207 1K
L230 10μ
Q208 (2SC2412K) (BR) (CHANGED)
PB AMP
PBSV
L202 100μ
C207
R212 680
R213 180
C206 0.022
L229 220μ
R314 470
L201 27μ
R315 1K
SW



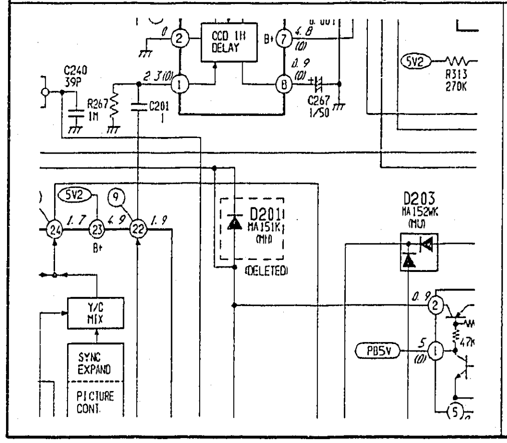
REC EQ
C278 10P
R207 1K
L230 10μ
Q208 KSC1623 (C|G)
PB AMP
PBSV
L202 100μ
C207
R212 680
R213 180
C206 0.022
L229 220μ
R314 470
L201 27μ
R315 1K
SW

7. LUMA/CHROMA Schematic Diagram

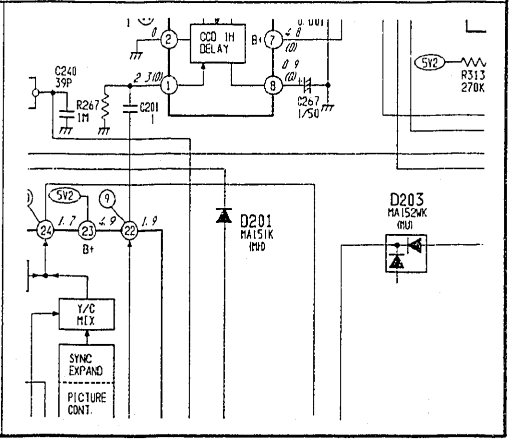
(Only the changed sections are shown here.)

ITEM MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-5400A	No.3526E	5-33~5-34	XXXX2501 and later
VM-4400A	No.3517E	5-33~5-34	XXX12501 and later
VM-4450A(PX)	No.3517E	5-33~5-34	XXXX1501 and later
VM-4450AW	No.3517E	5-33~5-34	XXXXX501 and later

After Change	Before Change
VM-5400A : PAGE 5-34 (5-D) VM-4400A : PAGE 5-34 (5-D)	VM-4450A(PX) : PAGE 5-34 (5-D) VM-4450AW : PAGE 5-34 (5-D)

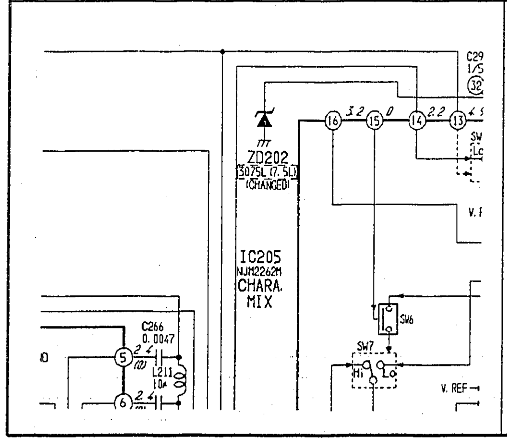


CCD 1H DELAY
C240 39P
R267 1M
C201
C267 1/50
5V2
R313 270K
D201 MA151K (MI)
(DELETED)
D203 MA152WK (MU)
B+
Y/C MIX
SYNC EXPAND
PICTURE CONT.
PB5V
47K

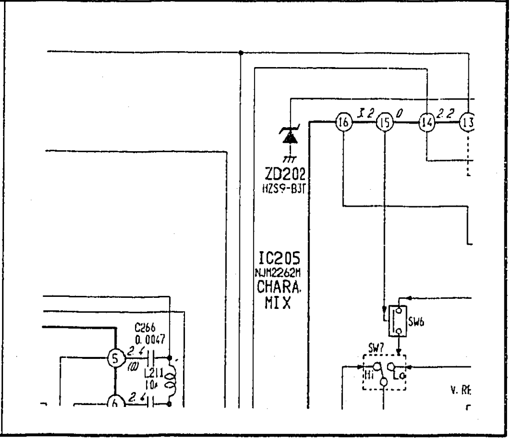


CCD 1H DELAY
C240 39P
R267 1M
C201
C267 1/50
5V2
R313 270K
D201 MA151K (MI)
D203 MA152WK (MU)
B+
Y/C MIX
SYNC EXPAND
PICTURE CONT.

After Change	Before Change
VM-5400A : PAGE 5-34 (6-E) VM-4400A : PAGE 5-34 (6-E)	VM-4450A(PX) : PAGE 5-34 (6-E) VM-4450AW : PAGE 5-34 (6-E)



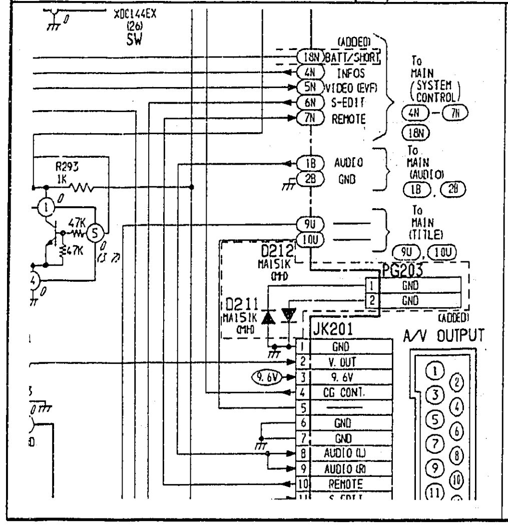
ZD202 (3075L (7.5L)) (CHANGED)
IC205 NJM2262M CHARA. MIX
C266 0.0047
L211 10μ
SW6
SW7
V. REF
V. F



ZD202 HZS9-B3T
IC205 NJM2262M CHARA. MIX
C266 0.0047
L211 10μ
SW6
SW7
V. RE

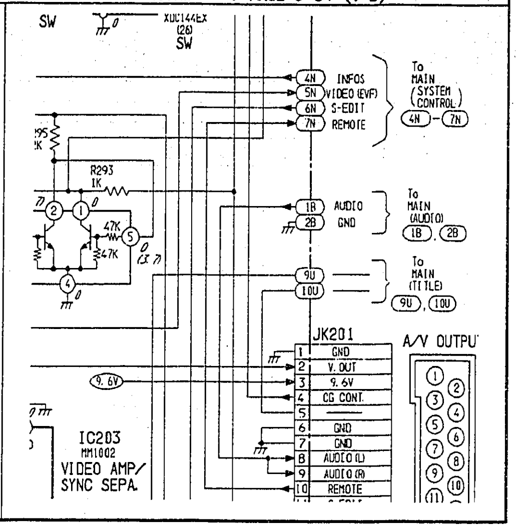
After Change

VM-5400A : PAGE 5-34 (7-B)
VM-4400A : PAGE 5-34 (7-B)


XDC144EX
(26)
SW
(ADDED)
18N BATT/SHORT
4N INFOS
5N VIDEO (EVF)
6N S-EDIT
7N REMOTE
To MAIN (SYSTEM CONTROL) 4N - 7N 18N
1B AUDIO
2B GND
To MAIN (AUDIO) 1B, 2B
9U
10U
To MAIN (TITLE) 9U, 10U
R293 1K
47K
47K
D212 MA151K (MHD)
D211 MA151K (MHD)
PG203
1 GND
2 GND
(ADDED)
JK201
1 GND
2 V. OUT
3 9.6V
4 CG CONT.
5
6 GND
7 GND
8 AUDIO (L)
9 AUDIO (R)
10 REMOTE
9.6V
A/V OUTPUT

Before Change

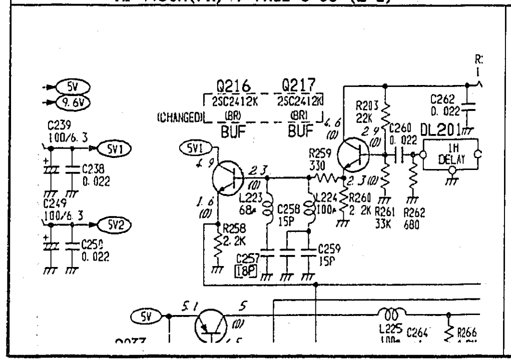
VM-4450A(PX) : PAGE 5-34 (7-B)
VM-4450AW : PAGE 5-34 (7-B)


SW
XDC144EX
(26)
SW
4N INFOS
5N VIDEO (EVF)
6N S-EDIT
7N REMOTE
To MAIN (SYSTEM CONTROL) 4N - 7N
R293 1K
47K
47K
1B AUDIO
2B GND
To MAIN (AUDIO) 1B, 2B
9U
10U
To MAIN (TITLE) 9U, 10U
JK201
1 GND
2 V. OUT
3 9.6V
4 CG CONT.
5
6 GND
7 GND
8 AUDIO (L)
9 AUDIO (R)
10 REMOTE
9.6V
A/V OUTPUT
IC203
MM1002
VIDEO AMP/
SYNC SEPA.

ITEM / MODEL'S NAME	Service Manual No.	PAGE	Units with Serial No.
VM-4450A(PX)	No.3517E	5-33~5-34	XXXX2301 ~ XXXX3300
VM-4450AW	No.3517E	5-33~5-34	XXXX1501 ~ XXXX2000

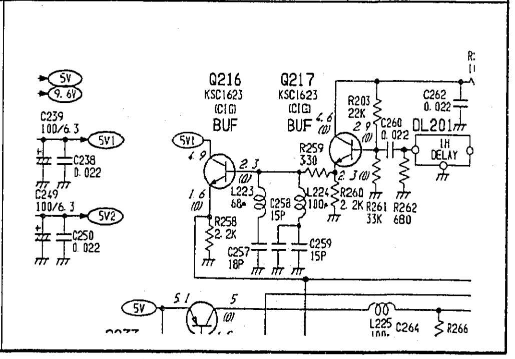
After Change

VM-4450A(PX) : PAGE 5-33 (2-E)


5V
9.6V
C239 100/6.3
C238 0.022
C249 100/6.3
C250 0.022
5V1
5V2
Q216 2SC2412K (BR) BUF
Q217 2SC2412K (BR) BUF
(CHANGED)
L223 68μ
R258 2.2K
C257 18P
C258 15P
R259 330
L224 100μ
R260 2.2K
C259 15P
R203 22K
C260 0.022
C262 0.022
DL201
1H DELAY
R261 33K
R262 680
L225 100μ
C264
R266

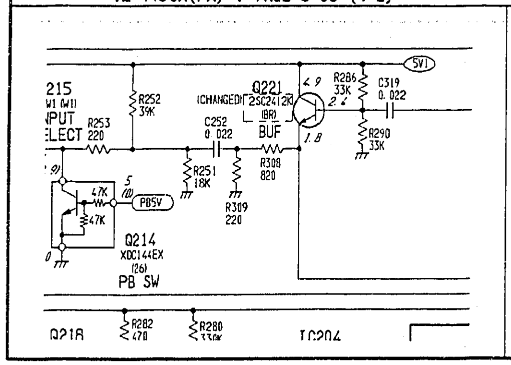
Before Change

VM-4450AW : PAGE 5-33 (2-E)


5V
9.6V
C239 100/6.3
C238 0.022
C249 100/6.3
C250 0.022
5V1
5V2
Q216 KSC1623 (C1G) BUF
Q217 KSC1623 (C1G) BUF
L223 68μ
R258 2.2K
C257 18P
C258 15P
R259 330
L224 100μ
R260 2.2K
C259 15P
R203 22K
C260 0.022
C262 0.022
DL201
1H DELAY
R261 33K
R262 680
L225 100μ
C264
R266

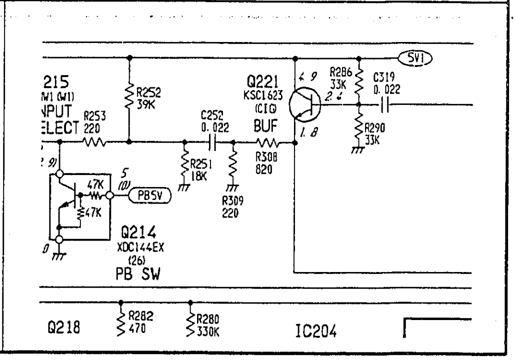
After Change

VM-4450A(PX) : PAGE 5-33 (4-E)


215
INPUT SELECT
R253 220
R252 39K
C252 0.022
Q221 2SC2412K (BR) BUF
(CHANGED)
R286 33K
C319 0.022
R290 33K
5V1
R251 18K
R308 820
R309 220
47K
47K
PB5V
Q214 XDC144EX (26) PB SW
Q218
R282 470
R280 330K
IC204

Before Change

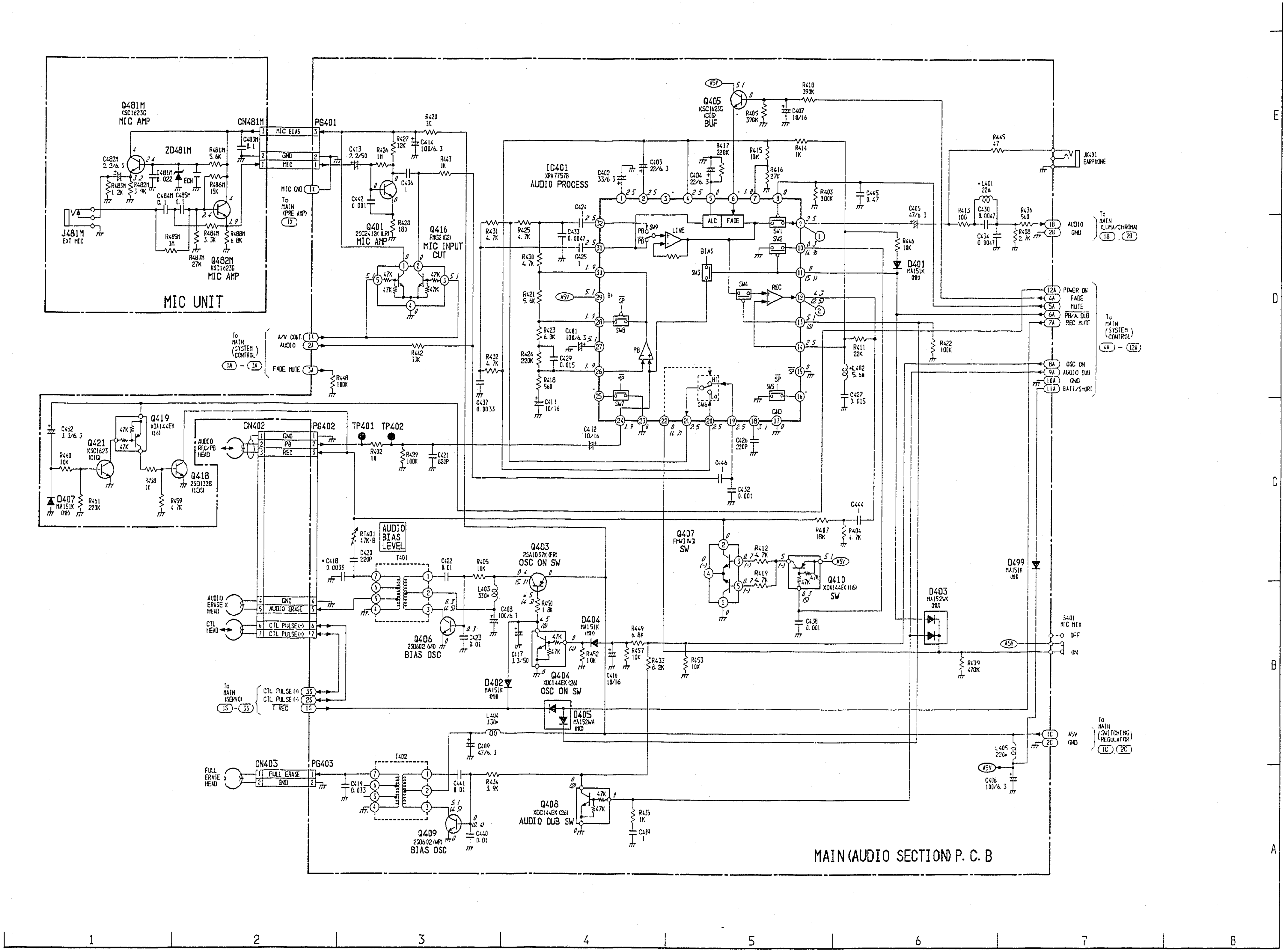
VM-4450AW : PAGE 5-33 (4-E)


215
INPUT SELECT
R253 220
R252 39K
C252 0.022
Q221 KSC1623 (C1G) BUF
R286 33K
C319 0.022
R290 33K
5V1
R251 18K
R308 820
R309 220
47K
47K
PB5V
Q214 XDC144EX (26) PB SW
Q218
R282 470
R280 330K
IC204

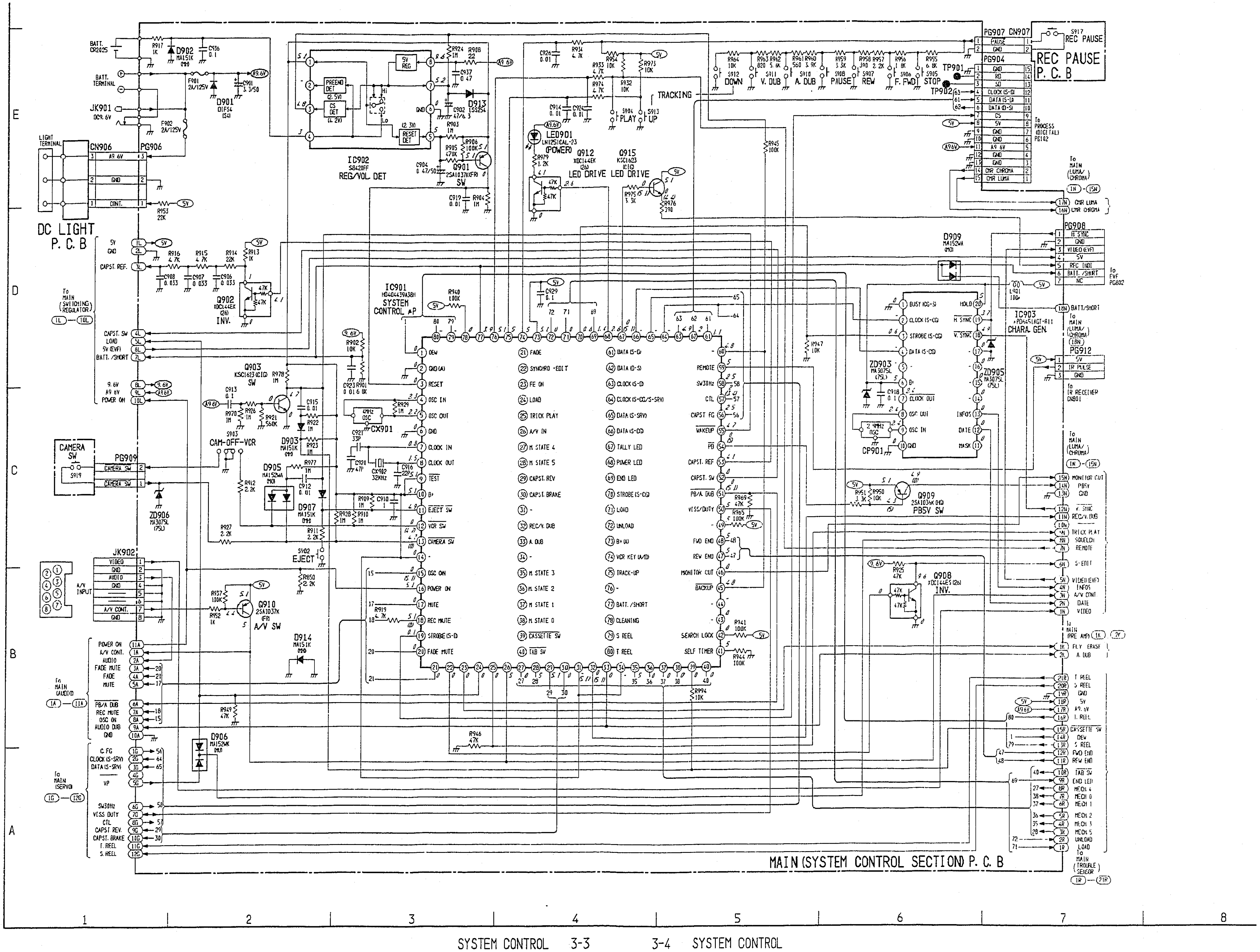
SCHEMATIC & CIRCUIT BOARD DIAGRAMS

MODEL's : VM-4400A
VM-4450AW, A
VM-5400A

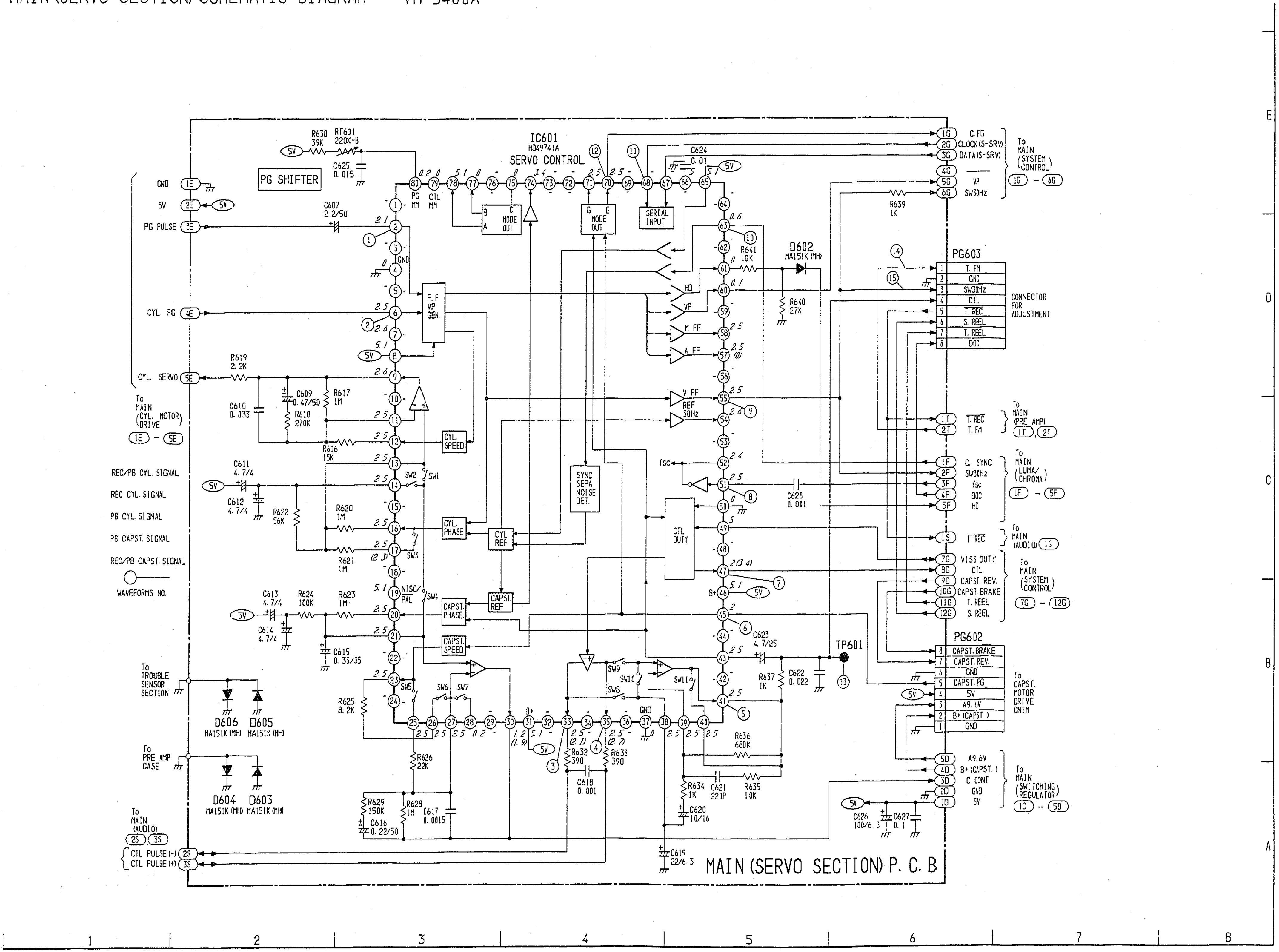
MAIN (AUDIO SECTION) SCHEMATIC DIAGRAM -VM-5400A-


MIC UNIT
Q481M KSC1623G MIC AMP
ZD481M
Q482M KSC1623G MIC AMP
J481M EXT MIC
CN481M
PG401
MIC BIAS
GND
MIC
MIC GND
To MAIN (PRE AMP)
Q401 2SC2412K (LR) MIC AMP
Q416 FM32 (G2) MIC INPUT CUT
To MAIN (SYSTEM CONTROL) 1A - 3A
A/V CONT
AUDIO
FADE MUTE
IC401 XRA7757B AUDIO PROCESS
Q405 KSC1623G (C1G) BUF
LINE
ALC
FADE
BIAS
REC
PB
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
Hi
Lo
GND
D401 MA151K
JK401 EARPHONE
L401
AUDIO
GND
To MAIN (LUMA/CHROMA) 1B, 2B
POWER ON
FADE MUTE
PB/A DUB
REC MUTE
To MAIN (SYSTEM CONTROL) 4A - 12A
OSC ON
AUDIO DUB
GND
BATT/SHORT
Q419 XDA144EK (16)
Q421 KSC1623 (C1G)
Q418 2SD1328 (1DS)
D407 MA151K
CN402
PG402
AUDIO REC/PB HEAD
PB
REC
TP401
TP402
RT401 47K-B
AUDIO BIAS LEVEL
T401
Q403 2SA1037K (FR) OSC ON SW
Q406 2SD602 (WR) BIAS OSC
Q404 XDC144EK (26) OSC ON SW
D404 MA151K
D402 MA151K
D405 MA152WA
Q407 FMW1 (W1) SW
Q410 XDA144EK (16) SW
D499 MA151K
D403 MA152WK
S401 MIC MIX
OFF
ON
To MAIN (SWITCHING REGULATOR) 1C, 2C
A5V
AUDIO ERASE HEAD
CTL HEAD
AUDIO ERASE
CTL PULSE (-)
CTL PULSE (+)
To MAIN (SERVO) 1S - 3S
T. REC
CN403
PG403
FULL ERASE HEAD
FULL ERASE
T402
Q408 XDC144EK (26) AUDIO DUB SW
Q409 2SD602 (WR) BIAS OSC
MAIN (AUDIO SECTION) P. C. B
A
B
C
D
E
1
2
3
4
5
6
7
8

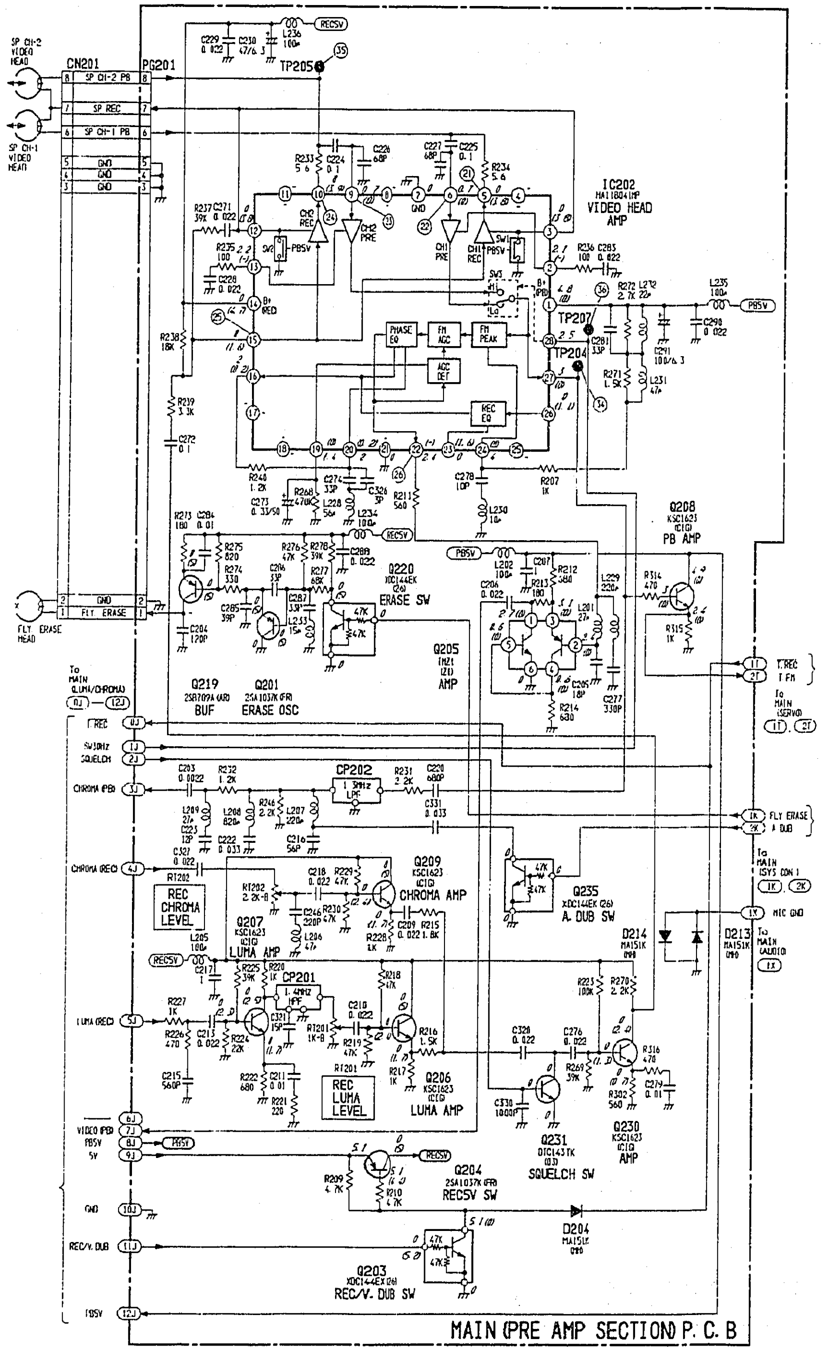
MAIN (SYSTEM CONTROL SECTION) SCHEMATIC DIAGRAM -VM-5400A-


BATT. CR2025
BATT. TERMINAL
JK901 DC9. 6V
D902 MA151K
F901 2A/125V
D901 01FS4
F902 2A/125V
C901 3.3/50
LIGHT TERMINAL
CN906
PG906
A9.6V
GND
CONT.
R953 22K
DC LIGHT P. C. B
IC902 S8420FF REG/VOL DET
PREEND DET
CS DET
RESET DET
5V REG
D913 1SS254
Q901 2SA1037K(FR) SW
LED901 LN12S1CAL-23 (POWER)
Q912 XDC144EK LED DRIVE
Q915 KSC1623 LED DRIVE
S904 PLAY
S913 UP
TRACKING
S912 DOWN
S911 V. DUB
S910 A. DUB
S908 PAUSE
S907 REW
S906 F. FWD
S905 STOP
TP901
TP902
PG907 CN907
S917 REC PAUSE
REC PAUSE P. C. B
PG904
PAUSE
GND
RO
SO
CLOCK (S-D)
DATA (S-D)
DATA (D-S)
CS
5V
A9.6V
CHR CHROMA
CHR LUMA
To PROCESS (DIGITAL) PG102
To MAIN (LUMA/CHROMA)
PG908
H SYNC
VIDEO (EVF)
REC IND
BATT./SHORT
NC
To EVF PG802
D909 MA152WA
IC901 HD404439A38H SYSTEM CONTROL µP
IC903 µPD6451AGT-811 CHARA. GEN.
ZD903 MA3075L
ZD905 MA3075L
CP901
Q909 2SA1037K(FR) PB5V SW
Q908 XDC144ES INV.
PG912
IR PULSE
To IR RECEIVER CN801
To MAIN (SW1101NG REGULATOR)
CAPST. REF.
Q902 XDC144EK INV.
CAPST. SW
LOAD
5V (EVF)
BATT./SHORT
9.6V
A9.6V
POWER ON
Q903 KSC1623(C1D) SW
S903 CAM-OFF-VCR
CX901
CX902 32KHz
D903 MA151K
D905 MA152WA
D907 MA151K
S902 EJECT
CAMERA SW
S919
PG909
ZD906 MA3075L
JK902
VIDEO
AUDIO
A/V CONT.
A/V INPUT
Q910 2SA1037K(FR) A/V SW
D914 MA151K
D906 MA152WK
To MAIN (AUDIO)
POWER ON
A/V CONT.
AUDIO
FADE MUTE
FADE
MUTE
PB/A DUB
REC MUTE
OSC ON
AUDIO DUB
To MAIN (SERVO)
C.FG
CLOCK (S-SRV)
DATA (S-SRV)
VP
SW30Hz
VISS DUTY
CTL
CAPST REV.
CAPST. BRAKE
T. REEL
S. REEL
DEW
OSC IN
OSC OUT
CLOCK IN
CLOCK OUT
TEST
EJECT SW
VCR SW
POWER ON
MUTE
REC MUTE
STROBE (S-D)
FADE MUTE
FADE
SYNCHRO-EDIT
FE ON
TRICK PLAY
A/V IN
M. STATE 4
M. STATE 5
CAPST. REV
CAPST. BRAKE
REC/V. DUB
A. DUB
M. STATE 3
M. STATE 2
M. STATE 1
M. STATE 0
CASSETTE SW
TAB SW
DATA (S-D)
DATA (D-S)
CLOCK (S-D)
CLOCK (S-CG/S-SRV)
DATA (S-SRV)
DATA (S-CG)
TALLY LED
POWER LED
END LED
STROBE (S-CG)
UNLOAD
B+ (A)
VCR KEY (A/D)
TRACK-UP
BATT./SHORT
CLEANING
REMOTE
SW30Hz
CAPST FG
WAKEUP
PB
CAPST. REF
PB/A DUB
VISS/DUTY
FWD END
REW END
MONITOR OUT
BACKUP
SEARCH LOCK
SELF TIMER
BUSY (CG-S)
CLOCK (S-CG)
STROBE (S-CG)
DATA (S-CG)
HOLD
H. SYNC
V. SYNC
INFOS
DATE
MASK
MONITOR OUT
PB5V
V. SYNC
REC/V. DUB
TRICK PLAT
SQUELCH
REMOTE
S-EDIT
VIDEO (EVF)
A/V CONT
DATE
To MAIN (PRE AMP)
FLY ERASE
A. DUB
T. REEL
S. REEL
CASSETTE SW
FWD END
REW END
TAB SW
END LED
MECH 4
MECH 0
MECH 1
MECH 2
MECH 3
MECH 5
UNLOAD
LOAD
To MAIN (TROUBLE SENSOR)
MAIN (SYSTEM CONTROL SECTION) P. C. B
E
D
C
B
A
1
2
3
4
5
6
7
8

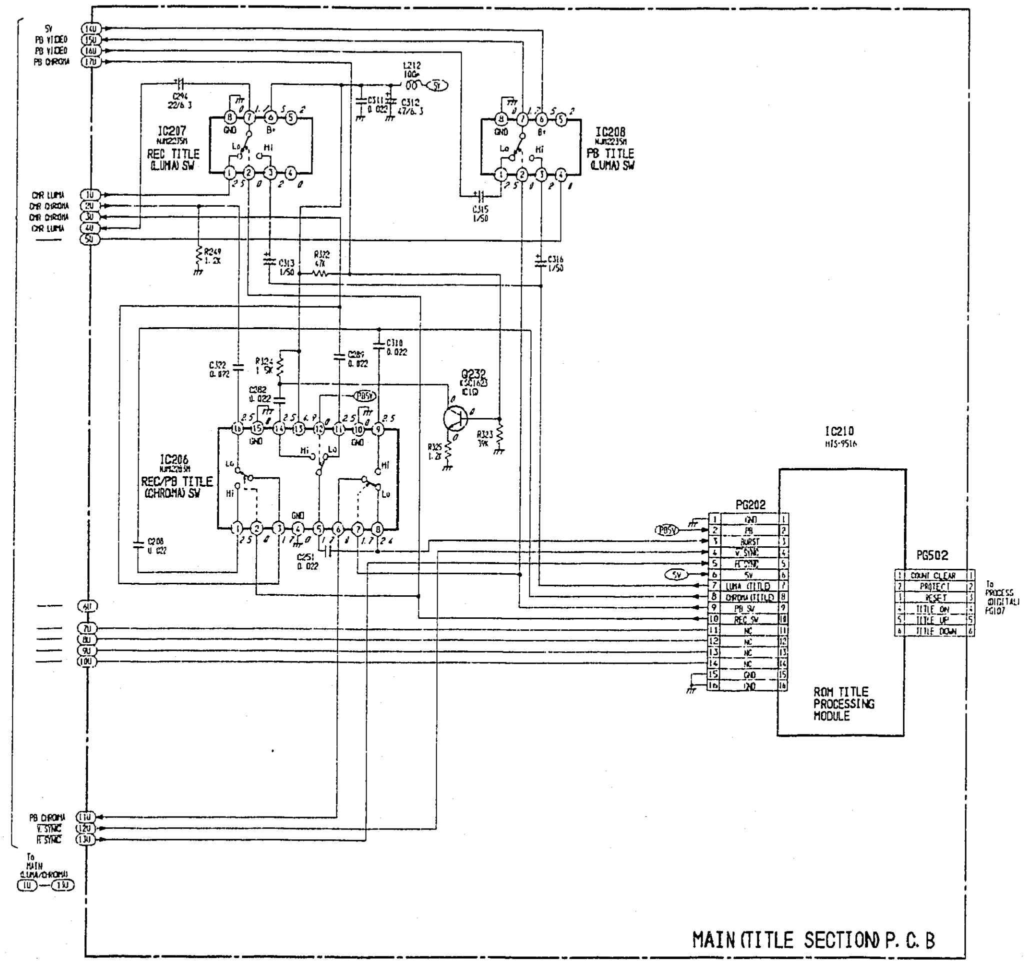
MAIN (SERVO SECTION) SCHEMATIC DIAGRAM -VM-5400A-


IC601
HD49741A
SERVO CONTROL
PG SHIFTER
R638 39K
RT601 220K-B
C625 0.015
C607 2.2/50
C624 0.01
GND
5V
PG PULSE
CYL FG
CYL. SERVO
To MAIN (CYL. MOTOR DRIVE)
1E - 5E
REC/PB CYL. SIGNAL
REC CYL. SIGNAL
PB CYL. SIGNAL
PB CAPST. SIGNAL
REC/PB CAPST. SIGNAL
WAVEFORMS NO.
R619 2.2K
C609 0.47/50
R617 1M
C610 0.033
R618 270K
R616 15K
C611 4.7/4
C612 4.7/4
R622 56K
R620 1M
R621 1M
C613 4.7/4
R624 100K
R623 1M
C614 4.7/4
C615 0.33/35
R625 8.2K
F.F VP GEN.
CYL SPEED
CYL PHASE
CYL REF
CAPST. PHASE
CAPST. REF
CAPST. SPEED
SYNC SEPA NOISE DET.
CTL DUTY
MODE OUT
SERIAL INPUT
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
SW10
SW11
NTSC/PAL
HD
VP
H FF
A FF
V FF
REF 30Hz
fsc
R641 10K
D602 MA151K (MH)
R640 27K
R639 1K
C628 0.001
C623 4.7/25
TP601
R637 1K
C622 0.022
R636 680K
R634 1K
C621 220P
R635 10K
C620 10/16
C619 22/6.3
R632 390
R633 390
C618 0.001
R626 22K
R629 150K
R628 1M
C617 0.0015
C616 0.22/50
To TROUBLE SENSOR SECTION
D606 MA151K (MH)
D605 MA151K (MH)
To PRE AMP CASE
D604 MA151K (MH)
D603 MA151K (MH)
To MAIN (AUDIO)
2S 3S
CTL PULSE (-)
CTL PULSE (+)
C.FG
CLOCK (S-SRV)
DATA (S-SRV)
VP
SW30Hz
To MAIN (SYSTEM CONTROL)
1G - 6G
PG603
T. FM
GND
SW30Hz
CTL
T. REC
S. REEL
T. REEL
DOC
CONNECTOR FOR ADJUSTMENT
T. REC
T. FM
To MAIN (PRE AMP)
1T, 2T
C. SYNC
SW30Hz
fsc
DOC
HD
To MAIN (LUMA/CHROMA)
1F - 5F
T. REC
To MAIN (AUDIO) 1S
VISS DUTY
CTL
CAPST. REV.
CAPST BRAKE
T. REEL
S. REEL
To MAIN (SYSTEM CONTROL)
7G - 12G
PG602
CAPST. BRAKE
CAPST. REV.
GND
CAPST. FG
5V
A9.6V
B+ (CAPST.)
GND
To CAPST. MOTOR DRIVE CN1M
A9.6V
B+ (CAPST.)
C. CONT
GND
5V
To MAIN (SWITCHING REGULATOR)
1D - 5D
C626 100/6.3
C627 0.1
MAIN (SERVO SECTION) P.C.B
E
D
C
B
A
1
2
3
4
5
6
7
8

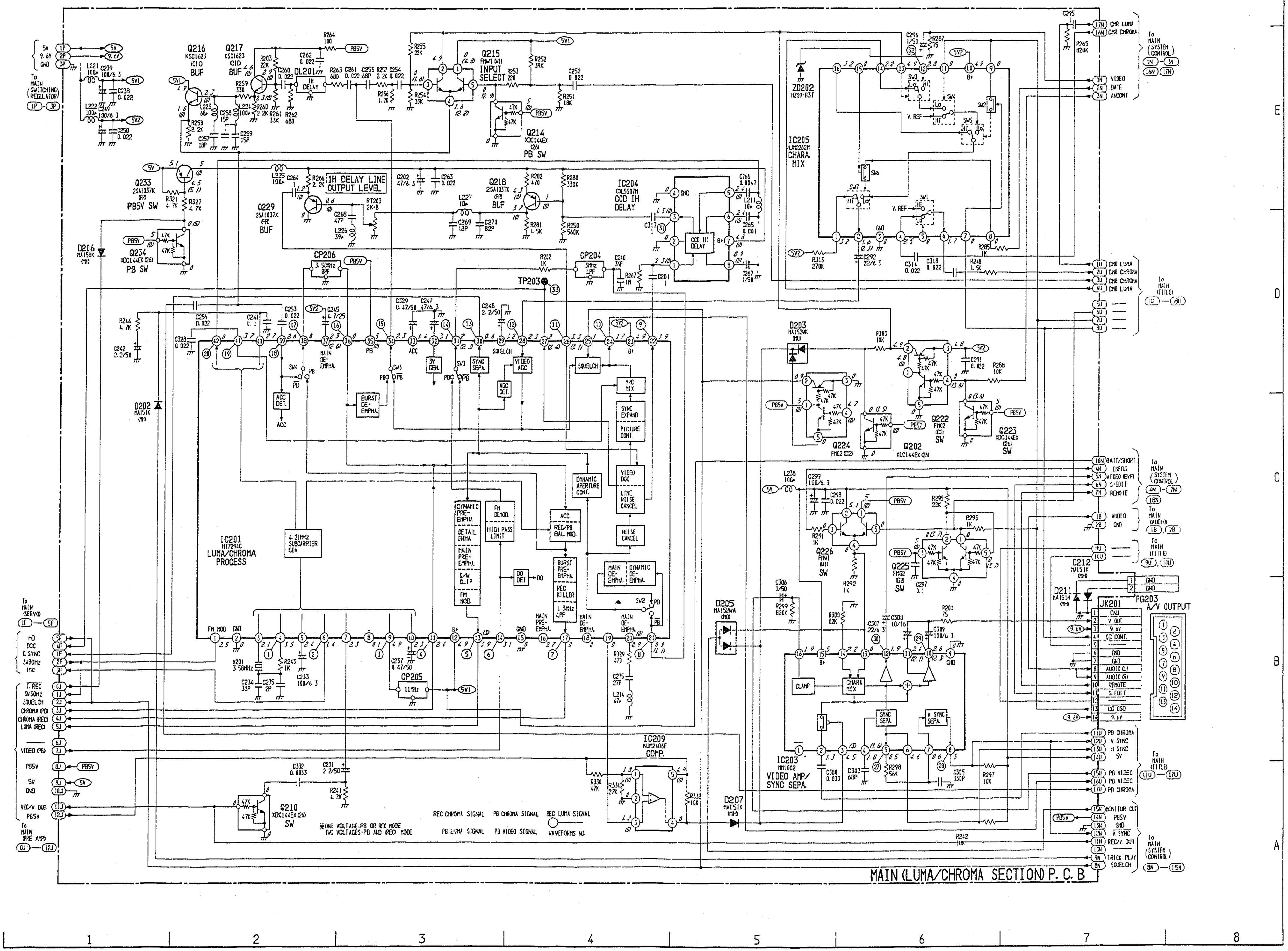
MAIN (PRE AMP SECTION) SCHEMATIC DIAGRAM -VM-5400A-


CN201
PG201
SP CH-2 VIDEO HEAD
SP CH-1 VIDEO HEAD
FLY ERASE HEAD
TP205
IC202 VIDEO HEAD AMP
TP207
TP204
Q208 PB AMP
Q220 ERASE SW
Q205 AMP
Q219 BUF
Q201 ERASE OSC
CP202
Q209 CHROMA AMP
Q235 A.DUB SW
REC CHROMA LEVEL
Q207 LUMA AMP
CP201
D214
D213
Q206 LUMA AMP
REC LUMA LEVEL
Q231 SQUELCH SW
Q230 AMP
Q204 REC5V SW
D204
Q203 REC/V.DUB SW
To MAIN (LUMA/CHROMA)
To MAIN (SERVO)
To MAIN (SYS CON)
To MAIN (AUDIO)
MAIN (PRE AMP SECTION) P. C. B

MAIN (TITLE SECTION) SCHEMATIC DIAGRAM -VM-5400A-


IC207 REC TITLE (LUMA) SW
IC208 PB TITLE (LUMA) SW
IC206 REC/PB TITLE (CHROMA) SW
Q232
IC210
PG202
PG502
ROM TITLE PROCESSING MODULE
To MAIN (LUMA/CHROMA)
MAIN (TITLE SECTION) P. C. B

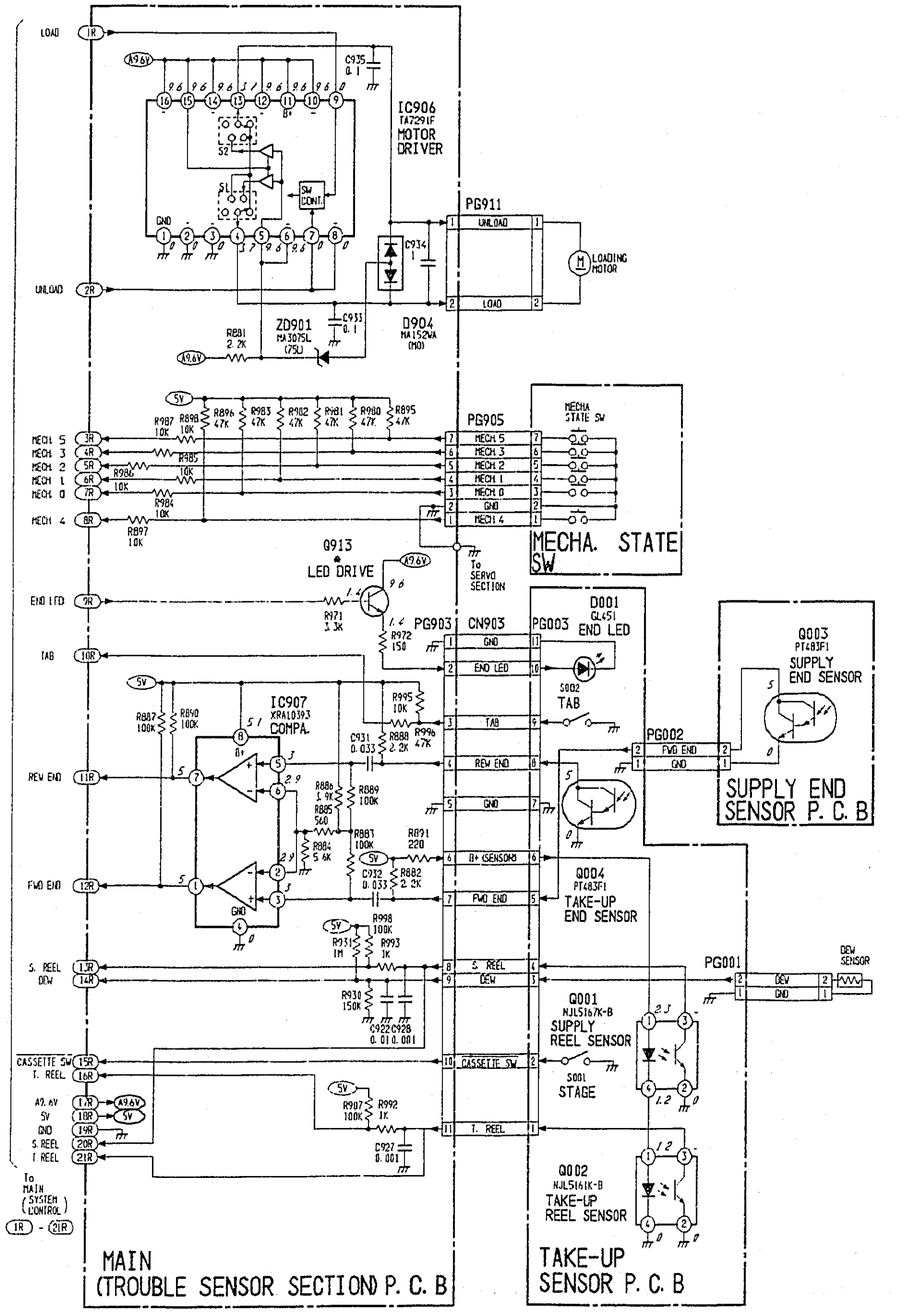
MAIN (LUMA/CHROMA SECTION) SCHEMATIC DIAGRAM -VM-5400A-


IC201 HA7294C LUMA/CHROMA PROCESS
IC204 CXL5507M CCD 1H DELAY
IC205 NJM2262M CHARA MIX
IC203 MM1002 VIDEO AMP/ SYNC SEPA.
IC209 NJM2406F COMP.
Q216 KSC1623 BUF
Q217 KSC1623 BUF
DL201 1H DELAY
Q215 FMW1 INPUT SELECT
Q214 XDC144EX PB SW
Q233 2SA1037K PB5V SW
Q234 XDC144EX PB SW
Q229 2SA1037K BUF
1H DELAY LINE OUTPUT LEVEL
RT203 2K-B
Q218 2SA1037K BUF
CP206 3.58MHz BPF
CP204 3MHz LPF
TP203
CP205 11MHz
Q210 XDC144EX SW
D203 MA152WK
Q224 FMG2 SW
Q202 XDC144EX SW
Q222 FMG2 SW
Q223 XDC144EX SW
Q226 FMW1 SW
Q225 FMG2 SW
D212 MA151K
D211 MA151K
D205 MA152WA
D207 MA151K
D206 MA151K
D202 MA151K
ZD202 HZS9-B3T
JK201
PG203 A/V OUTPUT
SQUELCH
Y/C MIX
SYNC EXPAND
PICTURE CONT.
VIDEO DOC
LINE NOISE CANCEL
NOISE CANCEL
DYNAMIC APERTURE CONT.
MAIN DE-EMPHA.
DYNAMIC DE-EMPHA.
BURST PRE-EMPHA.
REC KILLER
1.3MHz LPF
ACC
REC/PB BAL MOD.
DYNAMIC PRE-EMPHA.
DETAIL ENHA
MAIN PRE-EMPHA.
D/W CLIP
FM MOD
FM DEMOD.
HIGH PASS LIMIT
DO DET
4.21MHz SUBCARRIER GEN
ACC DET.
BURST DE-EMPHA.
3V GEN.
SYNC SEPA.
VIDEO AGC
CLAMP
CHARA MIX
V. SYNC SEPA.
To MAIN SWITCHING REGULATOR (1P)-(3P)
To MAIN (SYSTEM CONTROL)
To MAIN (TITLE)
To MAIN (AUDIO)
To MAIN (SERVO) (1F)-(5F)
To MAIN (PRE AMP) (1J)-(12J)
REC CHROMA SIGNAL
PB CHROMA SIGNAL
REC LUMA SIGNAL
PB LUMA SIGNAL
PB VIDEO SIGNAL
WAVEFORMS No.
※ONE VOLTAGE: PB OR REC MODE
TWO VOLTAGES: PB AND (REC) MODE
MAIN (LUMA/CHROMA SECTION) P. C. B
1
2
3
4
5
6
7
8
A
B
C
D
E

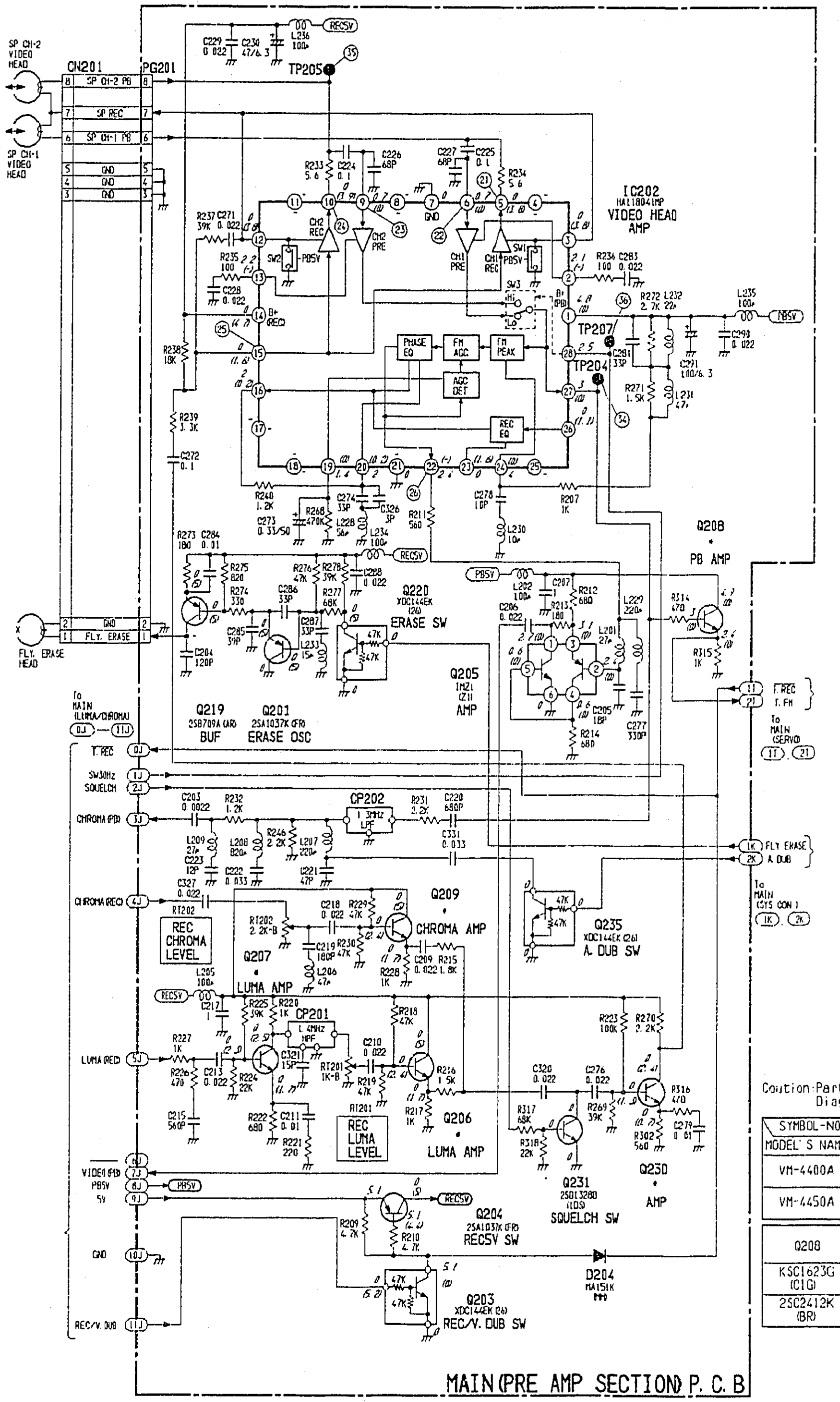
MAIN (TROBLE SENSOR SECTION) SCHEMATIC DIAGRAM -VM-4400A/4450A-

Coution:Parts marked • in the Schematic Diagrams are different for each model.

SYMBOL-NO / MODEL'S NAME	0913
VM-4400A	KSC1623G (C1G)
VM-4450A	2SC2412K (BR)


IC906 TA7291F MOTOR DRIVER
PG911
LOADING MOTOR
ZD901 MA3075L (75L)
D904 MA152WA (MO)
PG905
MECHA. STATE SW
Q913 • LED DRIVE
IC907 XRA10393 COMPA.
PG903
CN903
PG003
D001 GL451 END LED
S002 TAB
PG002
Q003 PT483F1 SUPPLY END SENSOR
SUPPLY END SENSOR P. C. B
Q004 PT483F1 TAKE-UP END SENSOR
PG001
DEW SENSOR
Q001 NJL5167K-B SUPPLY REEL SENSOR
S001 STAGE
Q002 NJL5161K-B TAKE-UP REEL SENSOR
To SERVO SECTION
To MAIN (SYSTEM CONTROL) 1R - 21R
MAIN (TROUBLE SENSOR SECTION) P. C. B
TAKE-UP SENSOR P. C. B

MAIN (PRE AMP SECTION) SCHEMATIC DIAGRAM -VM-4400A/4450A-


SP CH-2 VIDEO HEAD
SP CH-1 VIDEO HEAD
CN201
PG201
TP205
IC202 HA11894(MP) VIDEO HEAD AMP
TP207
TP204
Q208 • PB AMP
FLY. ERASE HEAD
Q220 XDC144EK (20) ERASE SW
Q205 IMZ1 (Z1) AMP
Q219 2SB709A (AR) BUF
Q201 2SA1037K (FR) ERASE OSC
To MAIN (LUMA/CHROMA)
CP202 3.58MHz LPF
Q209 • CHROMA AMP
REC CHROMA LEVEL
Q207 • LUMA AMP
CP201 1.4MHz HPF
REC LUMA LEVEL
Q206 • LUMA AMP
Q235 XDC144EK (26) A. DUB SW
Q230 • AMP
Q231 2SD1328B (1DS) SQUELCH SW
Q204 2SA1037K (FR) REC5V SW
D204 MA151K
Q203 XDC144EK (2A) REC/V. DUB SW
To MAIN (SERVO)
To MAIN (SYS CON)
MAIN (PRE AMP SECTION) P. C. B

Coution:Parts marked • in the Schematic Diagrams are different for each model

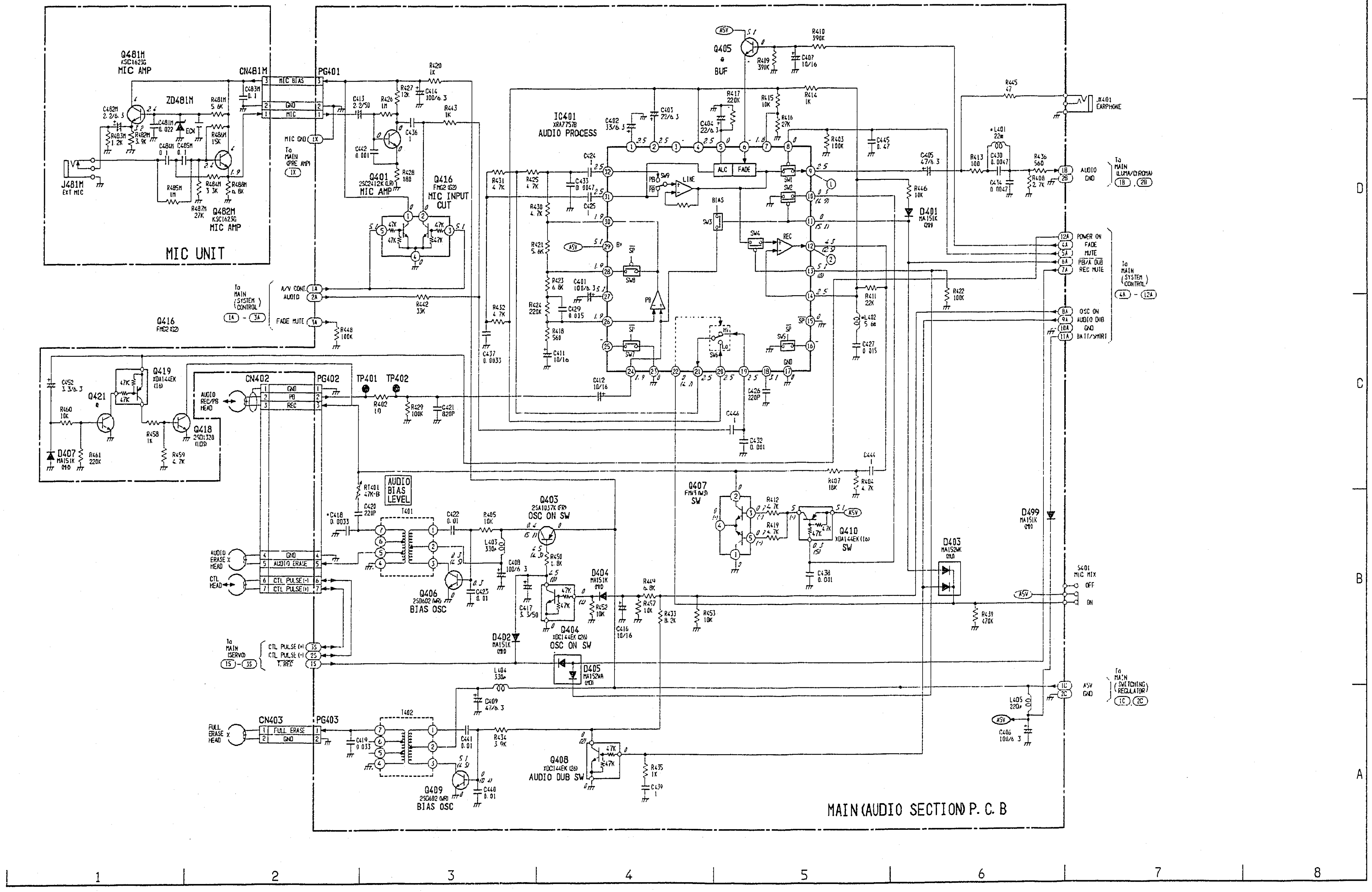
SYMBOL-NO / MODEL'S NAME	Q206	Q207
VM-4400A	KSC1623G (C1G)	KSC1623G (C1G)
VM-4450A	2SC2412K (BR)	2SC2412K (BR)

Q208	Q209	Q230
KSC1623G (C1G)	KSC1623G (C1G)	KSC1623G (C1G)
2SC2412K (BR)	2SC2412K (BR)	2SC2412K (BR)

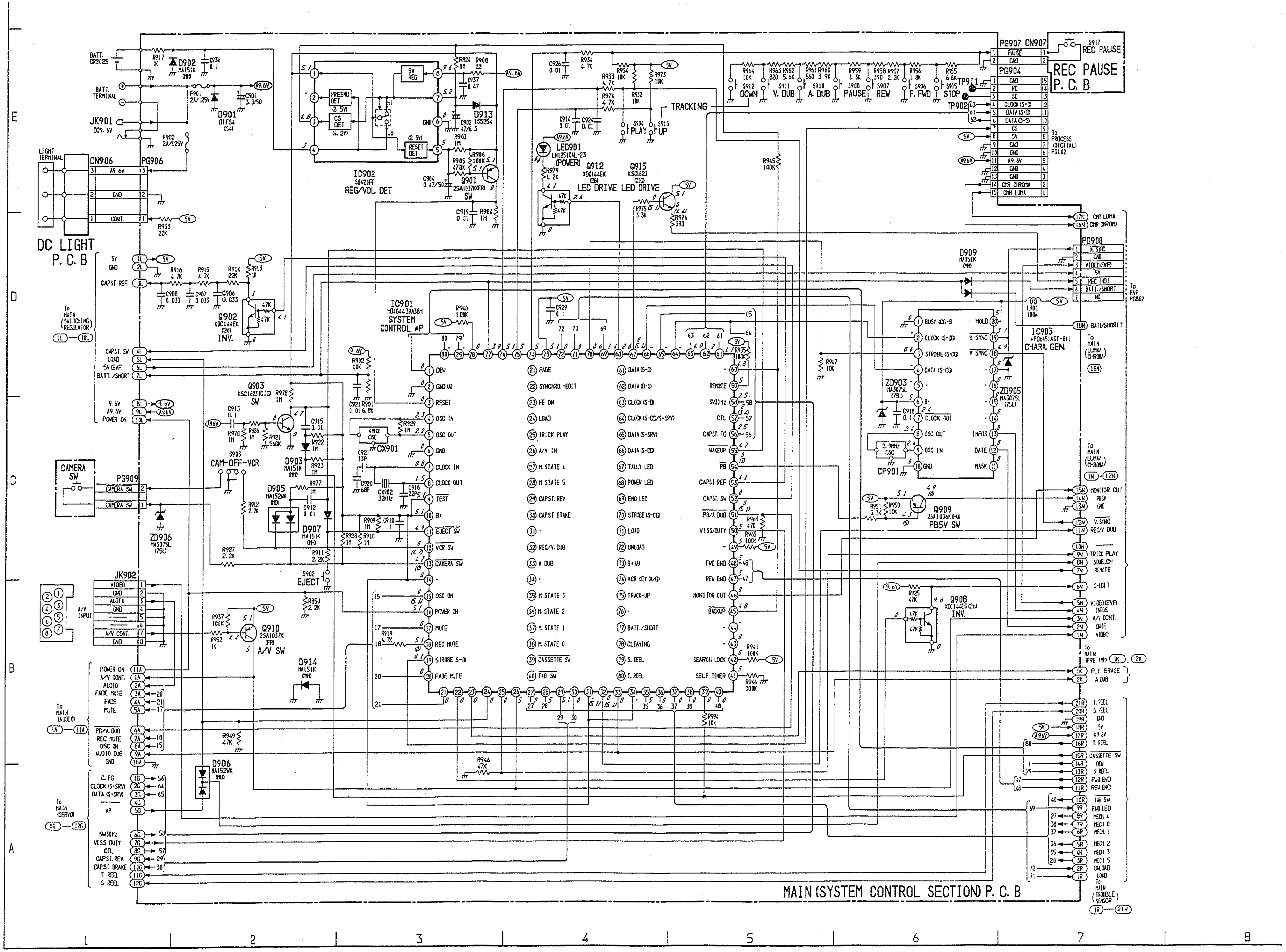
MAIN (AUDIO SECTION) SCHEMATIC DIAGRAM -VM-4400A/4450A-

Coution: Parts marked * in the Schematic
Diagrams are different for each model.

SYMBOL-NO MODEL'S NAME	Q405	Q421
VM-4400A	KSC1623G (C1G)	KSC1623G (C1G)
VM-4450A	2SC2412K (BR)	2SC2412K (BR)

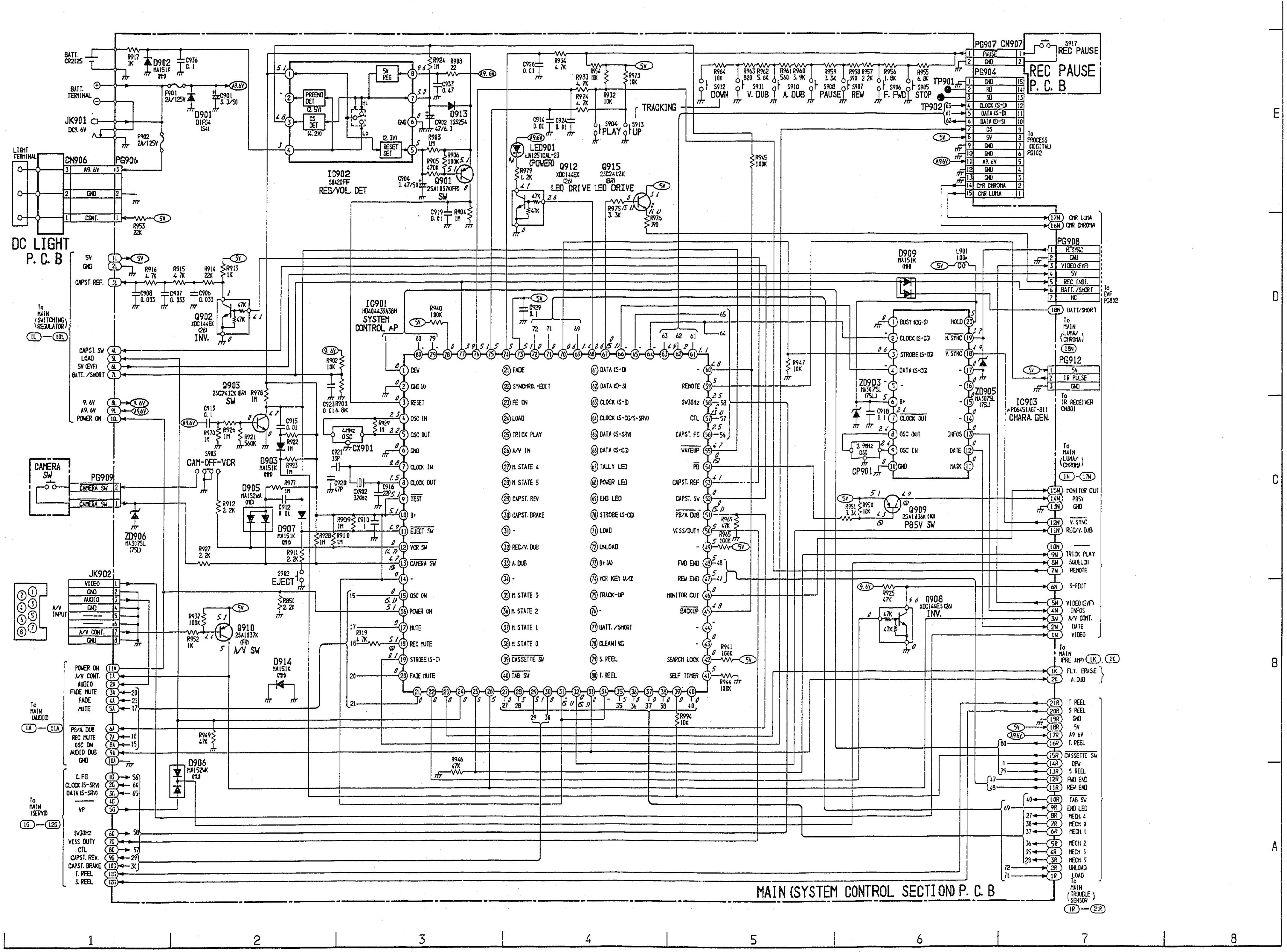

MIC UNIT
Q481M KSC1623G MIC AMP
ZD481M
Q482M KSC1623G MIC AMP
J481M EXT MIC
CN481M
PG401
MIC BIAS
GND
MIC
MIC GND
To MAIN (PRE AMP) (1X)
Q401 2SC2412K (LR) MIC AMP
Q416 FMG2 (G2) MIC INPUT CUT
To MAIN (SYSTEM CONTROL) (1A) - (3A)
A/V CONT.
AUDIO
FADE MUTE
Q416 FMG2 (G2)
IC401 XRA7757B AUDIO PROCESS
ALC
FADE
LINE
BIAS
REC
PB
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
Q405 * BUF
ASV
J401 EARPHONE
To MAIN (LUMA/CHROMA) (1B), (2B)
AUDIO
GND
POWER ON
FADE
MUTE
PB/A DUB
REC MUTE
To MAIN (SYSTEM CONTROL) (4A) - (12A)
OSC ON
AUDIO DUB
GND
BATT/SHORT
D401 MA151K
Q419 XDA144EK (16)
Q421 *
Q418 2SD1328 (10)
D407 MA151K
CN402
PG402
AUDIO REC/PB HEAD
GND
PB
REC
TP401
TP402
RT401 47K-B
AUDIO BIAS LEVEL
T401
AUDIO ERASE HEAD
AUDIO ERASE
CTL HEAD
CTL PULSE(-)
CTL PULSE(+)
To MAIN (SERVO) (1S) - (3S)
CTL PULSE (+)
CTL PULSE (-)
T.REC
Q403 2SA1037K (FR) OSC ON SW
Q406 2SD602 (WR) BIAS OSC
D404 MA151K
Q404 XDC144EK (26) OSC ON SW
D402 MA151K
D405 MA152WA
Q407 FMW1 (W1) SW
Q410 XDA144EK (16) SW
D499 MA151K
D403 MA152WK
S401 MIC MIX
OFF
ON
To MAIN (SWITCHING REGULATOR) (1C), (2C)
ASV
GND
CN403
PG403
FULL ERASE HEAD
FULL ERASE
GND
T402
Q409 2SD602 (WR) BIAS OSC
Q408 XDC144EK (26) AUDIO DUB SW
MAIN (AUDIO SECTION) P.C.B
E
D
C
B
A
1
2
3
4
5
6
7
8

MAIN (SYSTEM CONTROL SECTION) SCHEMATIC DIAGRAM -VM-4400A-

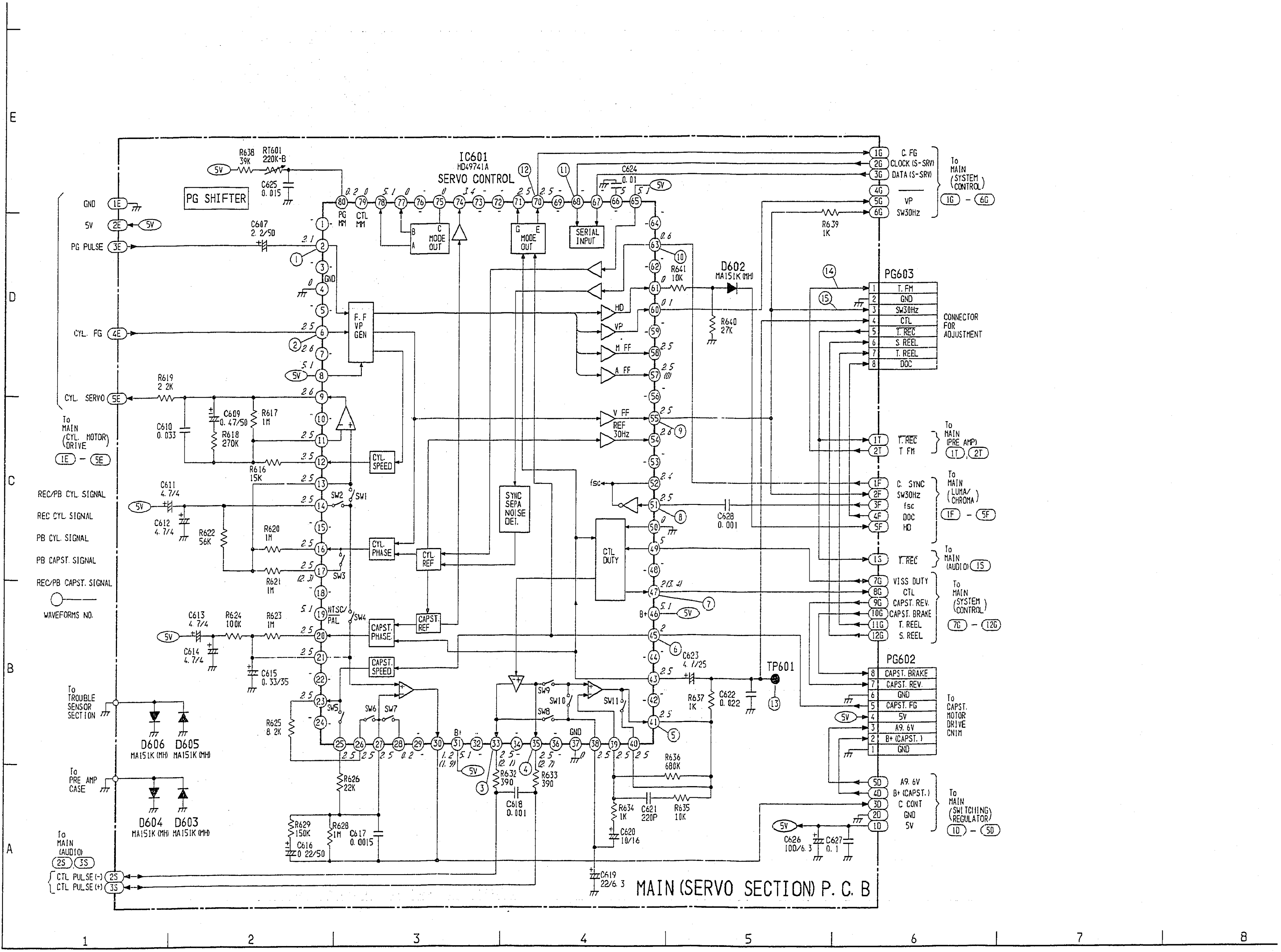


DC LIGHT P. C. B
LIGHT TERMINAL
CN906
PG906
BATT. CR2025
BATT. TERMINAL
JK901 DC9. 6V
D902 MA151K
F901 2A/125V
F902 2A/125V
D901 01FS4
IC902 S8428FF REG/VOL DET
PREEND DET (2. 5V)
CS DET (4. 2V)
5V REG
RESET DET
Q901 2SA1037K(FR) SW
D913 1SS254
LED901 LN1251CAL-23 (POWER)
Q912 XDC144EK LED DRIVE
Q915 KSC1623 LED DRIVE
S904 PLAY
S913 UP
TRACKING
S912 DOWN
S911 V. DUB
S910 A. DUB
S908 PAUSE
S907 REW
S906 F. FWD
S905 STOP
TP901
TP902
PG907 CN907
PG904
S917 REC PAUSE
REC PAUSE P. C. B
To PROCESS (DIGITAL) PG102
IC901 HD404439A38H SYSTEM CONTROL µP
Q902 XDC144EK INV.
Q903 KSC1623 SW
CX901 4MHz OSC
CX902 32KHz
S903 CAM-OFF-VCR
D903 MA151K
D905 MA152WA
D907 MA151K
S902 EJECT
CAMERA SW
PG909
ZD906 MA3075L
JK902 A/V INPUT
Q910 2SA1037K A/V SW
D914 MA151K
D906 MA152WK
To MAIN (SWITCHING REGULATOR)
To MAIN (AUDIO)
To MAIN (SERVO)
IC903 µPD6451AGT-811 CHARA. GEN.
ZD903 MA3075L
ZD905 MA3075L
CP901
D909 MA151K
PG908
To EVF PG802
Q909 2SA1036K PB5V SW
Q908 XDC144ES INV.
To MAIN (LUMA/CHROMA)
To MAIN (PRE AMP)
To MAIN (TROUBLE SENSOR)
MAIN (SYSTEM CONTROL SECTION) P. C. B
A
B
C
D
E
1
2
3
4
5
6
7
8

MAIN (SYSTEM CONTROL SECTION) SCHEMATIC DIAGRAM -VM-4450A-


DC LIGHT P. C. B
REC PAUSE P. C. B
MAIN (SYSTEM CONTROL SECTION) P. C. B
CAMERA SW
IC901 HD404439A38H SYSTEM CONTROL µP
IC902 S8420FF REG/VOL. DET
IC903 PD6451AGT-811 CHARA. GEN.
Q901 2SA1037K(FR) SW
Q902 XDC144EK (26) INV.
Q903 2SC2412K(6R) SW
Q908 XDC144ES (26) INV.
Q909 2SA1436K PB5V SW
Q910 2SA1037K (FR) A/V SW
Q912 XDC144EK (26) LED DRIVE
Q915 2SC2412K (6R) LED DRIVE
LED901 LN1251CAL-23 (POWER)
D901 D1FS4 (S4)
D902 MA151K
D903 MA151K
D905 MA152WA
D906 MA152WK
D907 MA151K
D909 MA151K
D913 1SS254
D914 MA151K
ZD903 MA3075L (75L)
ZD905 MA3075L (75L)
ZD906 MA3075L (75L)
JK901 DC9.6V
JK902 A/V INPUT
BATT. CR2125
BATT. TERMINAL
LIGHT TERMINAL
CN906
PG906
PG907 CN907
PG904
PG908
PG909
PG912
F901 2A/125V
F902 2A/125V
CX901 4MHz OSC
CX902 32KHz
CP901 2.9MHz OSC
S903 CAM-OFF-VCR
S902 EJECT
S904 PLAY
S913 UP
TRACKING
S912 DOWN
S911 V. DUB
S910 A. DUB
S908 PAUSE
S907 REW
S906 F. FWD
S905 STOP
S917 REC PAUSE
TP901
TP902
To PROCESS (DIGITAL) PG102
To EVF PG802
To MAIN (SWITCHING REGULATOR) (1L)—(10L)
To MAIN (AUDIO) (1A)—(11A)
To MAIN (SERVO) (1G)—(12G)
To MAIN (LUMA/CHROMA) (18N)
To MAIN (LUMA/CHROMA) (1N)—(17N)
To IR RECEIVER CN801
To MAIN (PRE AMP) (1K), (2K)
To MAIN (TROUBLE SENSOR) (1R)—(21R)
1
2
3
4
5
6
7
8
A
B
C
D
E

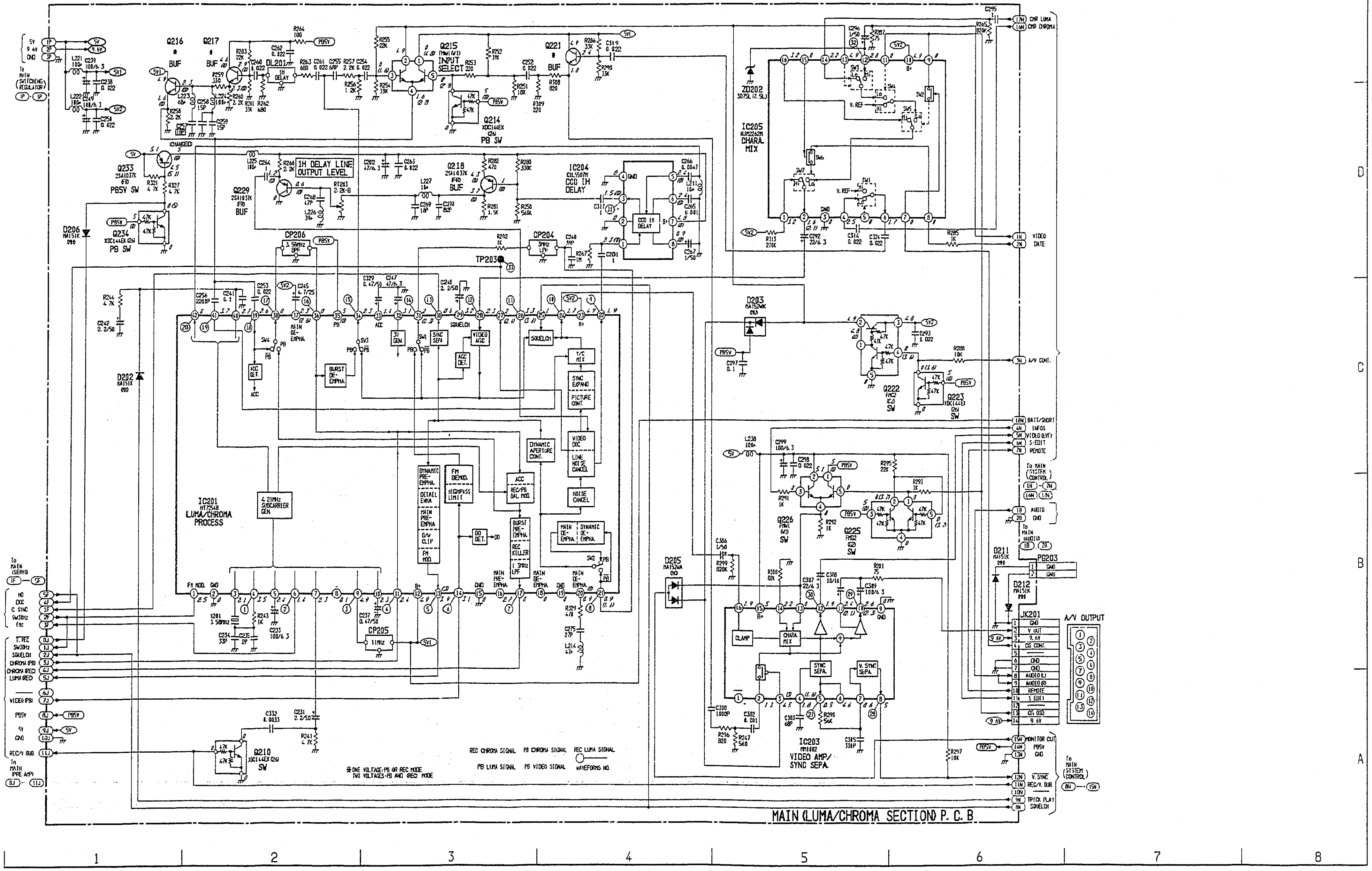
MAIN (SERVO SECTION) SCHEMATIC DIAGRAM -VM-4400A/4450A-


E
D
C
B
A
1
2
3
4
5
6
7
8
IC601
HD49741A
SERVO CONTROL
PG SHIFTER
R638 39K
RT601 220K-B
C625 0.015
C624 0.01
GND
5V
PG PULSE
CYL. FG
CYL. SERVO
To MAIN (CYL. MOTOR DRIVE)
1E - 5E
C607 2.2/50
F.F VP GEN
MODE OUT
SERIAL INPUT
HD
VP
H FF
A FF
V FF
REF 30Hz
R641 10K
D602 MA151K (MH)
R640 27K
R619 2.2K
C610 0.033
C609 0.47/50
R617 1M
R618 270K
R616 15K
CYL. SPEED
CYL. PHASE
CYL. REF
CAPST. PHASE
CAPST. REF
CAPST. SPEED
SYNC SEPA NOISE DET.
CTL DUTY
REC/PB CYL. SIGNAL
REC CYL. SIGNAL
PB CYL. SIGNAL
PB CAPST. SIGNAL
REC/PB CAPST. SIGNAL
WAVEFORMS NO.
C611 4.7/4
C612 4.7/4
R622 56K
R620 1M
R621 1M
C613 4.7/4
R624 100K
R623 1M
C614 4.7/4
C615 0.33/35
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
SW10
SW11
NTSC/PAL
R625 8.2K
R626 22K
R629 150K
R628 1M
C617 0.0015
C616 0.22/50
R632 390
R633 390
C618 0.001
R634 1K
C621 220P
R635 10K
R636 680K
C620 10/16
C619 22/6.3
R637 1K
C622 0.022
C623 4.7/25
C628 0.001
TP601
To TROUBLE SENSOR SECTION
D606 MA151K (MH)
D605 MA151K (MH)
To PRE AMP CASE
D604 MA151K (MH)
D603 MA151K (MH)
To MAIN (AUDIO) 2S 3S
CTL PULSE (-)
CTL PULSE (+)
C. FG
CLOCK (S-SRV)
DATA (S-SRV)
VP
SW30Hz
R639 1K
To MAIN (SYSTEM CONTROL) 1G - 6G
PG603
T. FM
GND
SW30Hz
CTL
T. REC
S REEL
T. REEL
DOC
CONNECTOR FOR ADJUSTMENT
T. REC
T FM
To MAIN (PRE AMP) 1T, 2T
C. SYNC
SW30Hz
fsc
DOC
HD
To MAIN (LUMA/CHROMA) 1F - 5F
T. REC
To MAIN (AUDIO) 1S
VISS DUTY
CTL
CAPST. REV.
CAPST. BRAKE
T. REEL
S. REEL
To MAIN (SYSTEM CONTROL) 7G - 12G
PG602
CAPST. BRAKE
CAPST. REV.
GND
CAPST. FG
5V
A9. 6V
B+ (CAPST.)
GND
To CAPST. MOTOR DRIVE CN1M
A9. 6V
B+ (CAPST.)
C CONT
GND
5V
To MAIN (SWITCHING REGULATOR) 1D - 5D
C626 100/6.3
C627 0.1
MAIN (SERVO SECTION) P. C. B

MAIN (LUMA/CHROMA SECTION) SCHEMATIC DIAGRAM -VM-4400A/4450A-

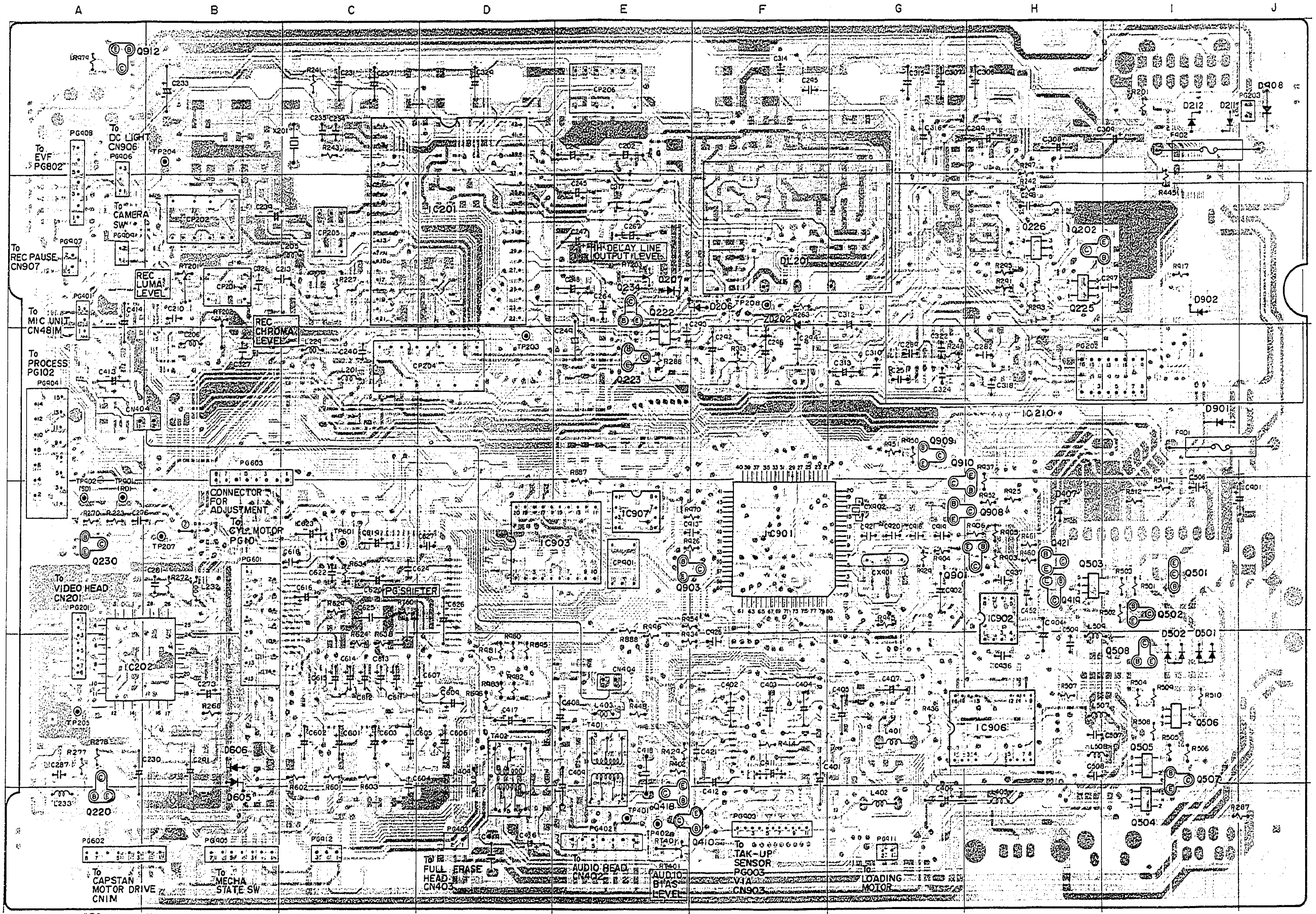
Coution: Parts marked ※ in the Schematic
Diagrams are different for each model.

SYMBOL-NO / MODEL' S NAME	Q216	Q217	Q221
VM-4400A	KSC1623G (C1G)	KSC1623G (C1G)	KSC1623G (C1G)
VM-4450A	2SC2412K (BR)	2SC2412K (BR)	2SC2412K (BR)



Q216 BUF
Q217 BUF
DL201 1H DELAY
Q215 INPUT SELECT
Q221 BUF
Q214 PB SW
ZD202
IC205 CHARA. MIX
Q233 PB5V SW
Q229 BUF
1H DELAY LINE OUTPUT LEVEL
Q218 BUF
IC204 CCD 1H DELAY
Q234 PB SW
D206
CP206
CP204
TP203
D203
Q222 SW
Q223 SW
D202
IC201 LUMA/CHROMA PROCESS
4.21MHz SUBCARRIER GEN
CP205
D205
IC203 VIDEO AMP/ SYNC SEPA.
Q226 SW
Q225 SW
D211
D212
PG203
JK201
A/V OUTPUT
Q210 SW
To MAIN (SWITCHING REGULATOR)
To MAIN (SERVO)
To MAIN (PRE AMP)
To MAIN (SYSTEM CONTROL)
VIDEO DATE
A/V CONT.
BATT/SHORT
INFOS
VIDEO (EVF)
S-EDIT
REMOTE
AUDIO
GND
V.OUT
9.6V
CG CONT.
AUDIO (L)
AUDIO (R)
S EDIT
OS OSD
MONITOR CUT
PB5V
V.SYNC
REC/V.DUB
TRICK PLAY
SQUELCH
REC CHROMA SIGNAL
PB CHROMA SIGNAL
REC LUMA SIGNAL
PB LUMA SIGNAL
PB VIDEO SIGNAL
WAVEFORMS NO.
※ONE VOLTAGE:PB OR REC MODE
TWO VOLTAGES:PB AND REC MODE
MAIN (LUMA/CHROMA SECTION) P. C. B
E
D
C
B
A
1
2
3
4
5
6
7
8

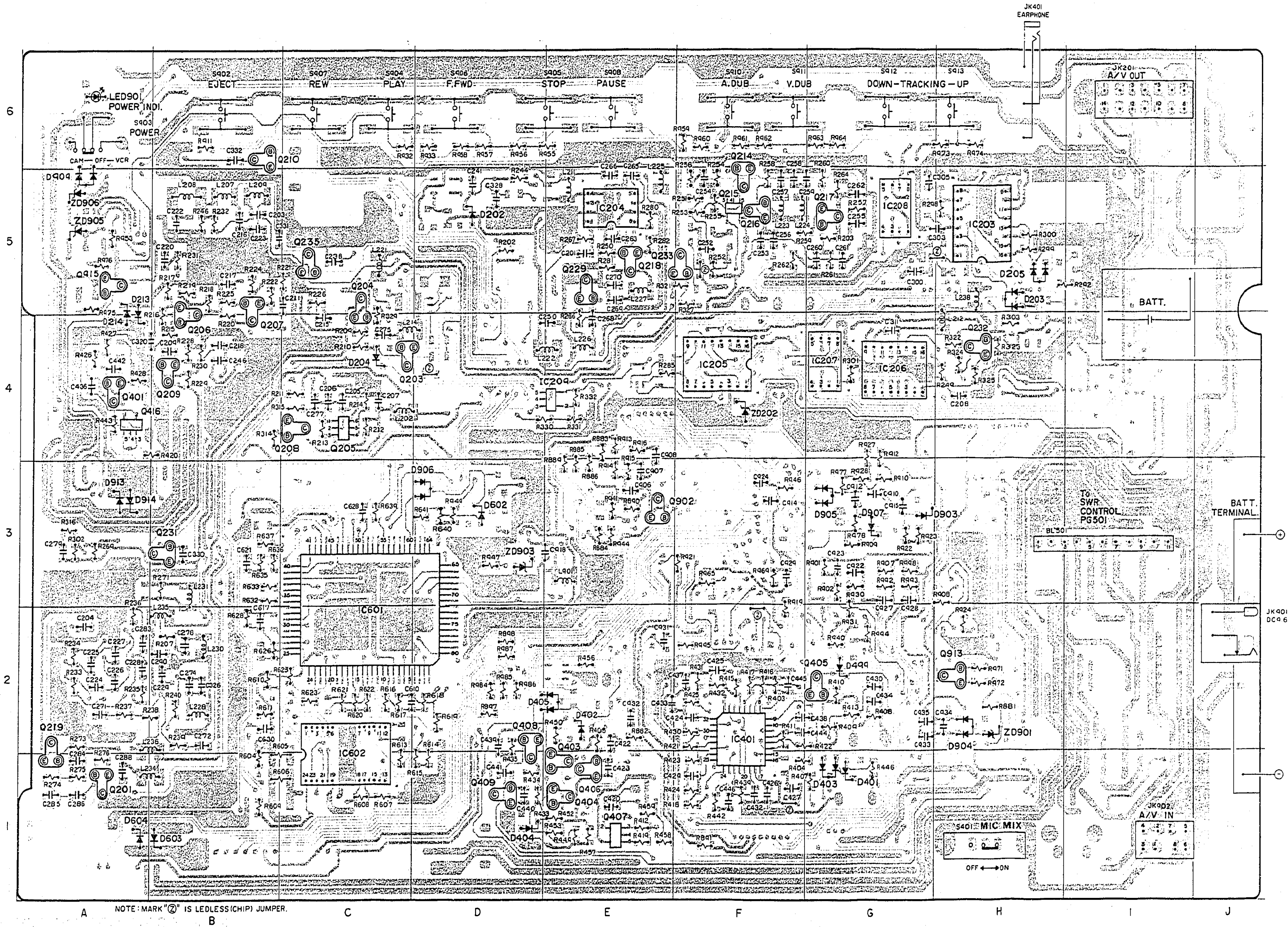
MAIN CIRCUIT BOARD DIAGRAM (COMPONENT SIDE) -VM-5400A-


A
B
C
D
E
F
G
H
I
J
1
2
3
4
5
6
To EVF PG802
To DC LIGHT CN906
To CAMERA SW
To REC PAUSE CN907
To MIC UNIT CN481M
To PROCESS PG102
REC LUMA LEVEL
REC CHROMA LEVEL
DELAY LINE OUTPUT LEVEL
CONNECTOR FOR ADJUSTMENT
To CYL MOTOR PG601
PG SHIFTER
To VIDEO HEAD CN201
IC201
IC202
IC210
IC901
IC902
IC903
IC906
IC907
Q912
Q230
Q220
Q222
Q223
Q226
Q202
Q225
Q903
Q908
Q909
Q910
Q901
Q421
Q419
Q503
Q501
Q502
Q508
Q505
Q506
Q507
Q504
Q418
Q410
D908
D212
D902
D901
D407
D502
D501
D606
D605
To CAPSTAN MOTOR DRIVE CN1M
To MECHA STATE SW
To FULL ERASE HEAD CN403
AUDIO HEAD CN402
AUDIO BIAS LEVEL
To TAK-UP SENSOR PG003 VIA CN903
To LOADING MOTOR

NOTE: MARK "②" IS LEADLESS (CHIP) JUMPER.

MAIN P.C.B(COMPONENT SIDE)

MAIN CIRCUIT BOARD DIAGRAM(SOLDER SIDE) -VM-5400A-


JK401 EARPHONE
S402 EJECT
S407 REW
S404 PLAY
S406 F.FWD
S405 STOP
S408 PAUSE
S410 A.DUB
S411 V.DUB
S412 DOWN-TRACKING-UP
S413
JK201 A/V OUT
LED901 POWER INDI.
S403 POWER
CAM—OFF—VCR
BATT.
To SWR CONTROL PG501
BL501
BATT. TERMINAL.
JK901 DC 6V
S401 MIC MIX
OFF ←→ ON
JK902 A/V IN
IC601
IC602
IC401
IC203
IC204
IC205
IC206
IC207
IC208
IC209
Q201
Q203
Q204
Q205
Q206
Q207
Q208
Q209
Q210
Q214
Q215
Q216
Q217
Q218
Q219
Q229
Q231
Q232
Q233
Q235
Q401
Q403
Q404
Q405
Q406
Q407
Q408
Q409
Q415
Q416
Q902
Q913
D202
D203
D204
D205
D213
D214
D401
D402
D403
D404
D405
D499
D602
D603
D604
D903
D904
D905
D906
D907
D909
D913
D914
ZD202
ZD901
ZD903
ZD905
ZD906
6
5
4
3
2
1
A
B
C
D
E
F
G
H
I
J

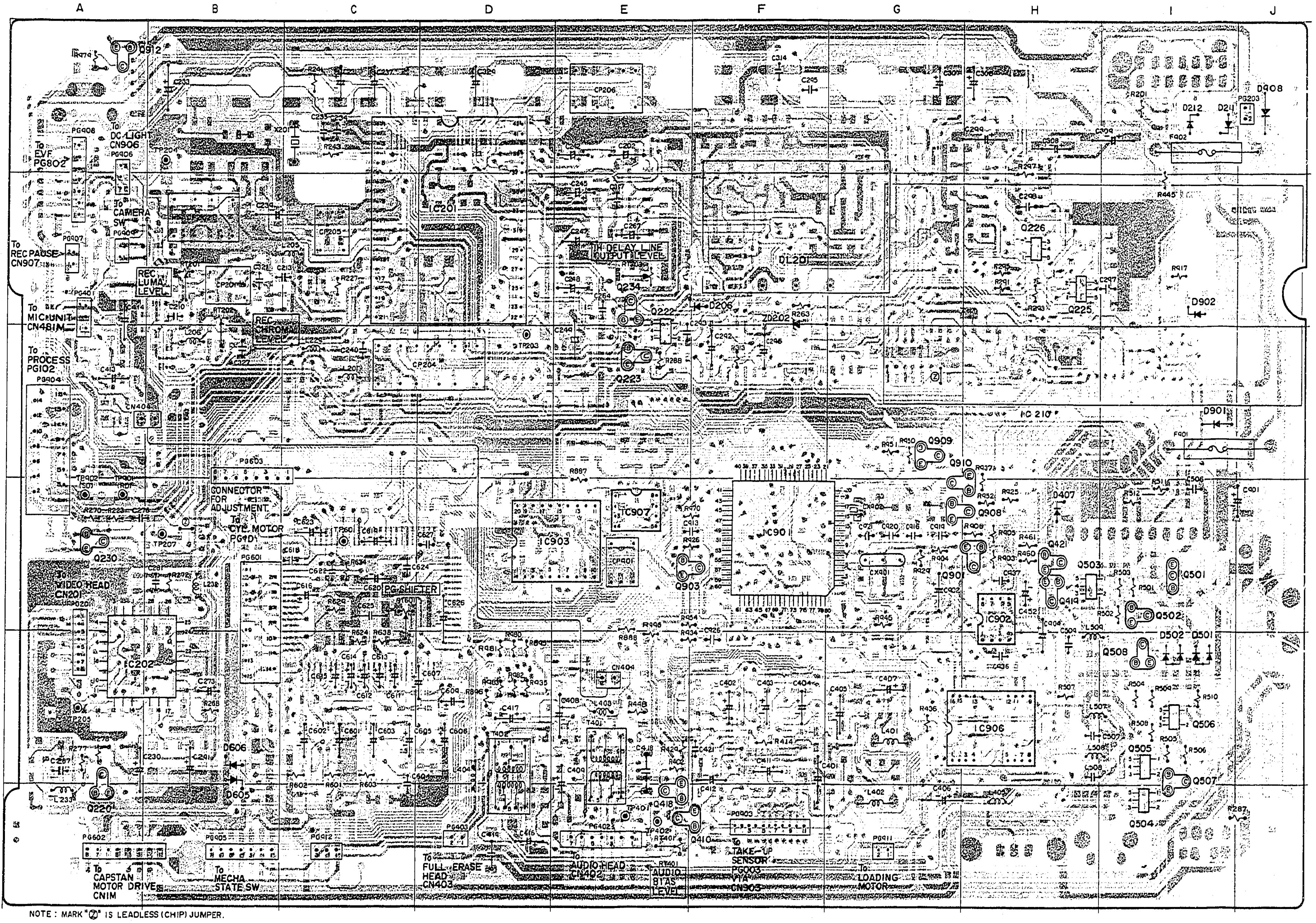
NOTE: MARK "②" IS LEDLESS(CHIP) JUMPER.

MAIN P.C.B(SOLDER SIDE)

MAIN CIRCUIT BOARD DIAGRAM (COMPONENT SIDE) -VM-4400A/4450A-

Coution: Parts marked * in the Circuit board diagrams are different for each model

SYMBOL NO. / MODEL'S NAME	PG912	R935
VM-4400A	×	○
VM-4450A	○	×

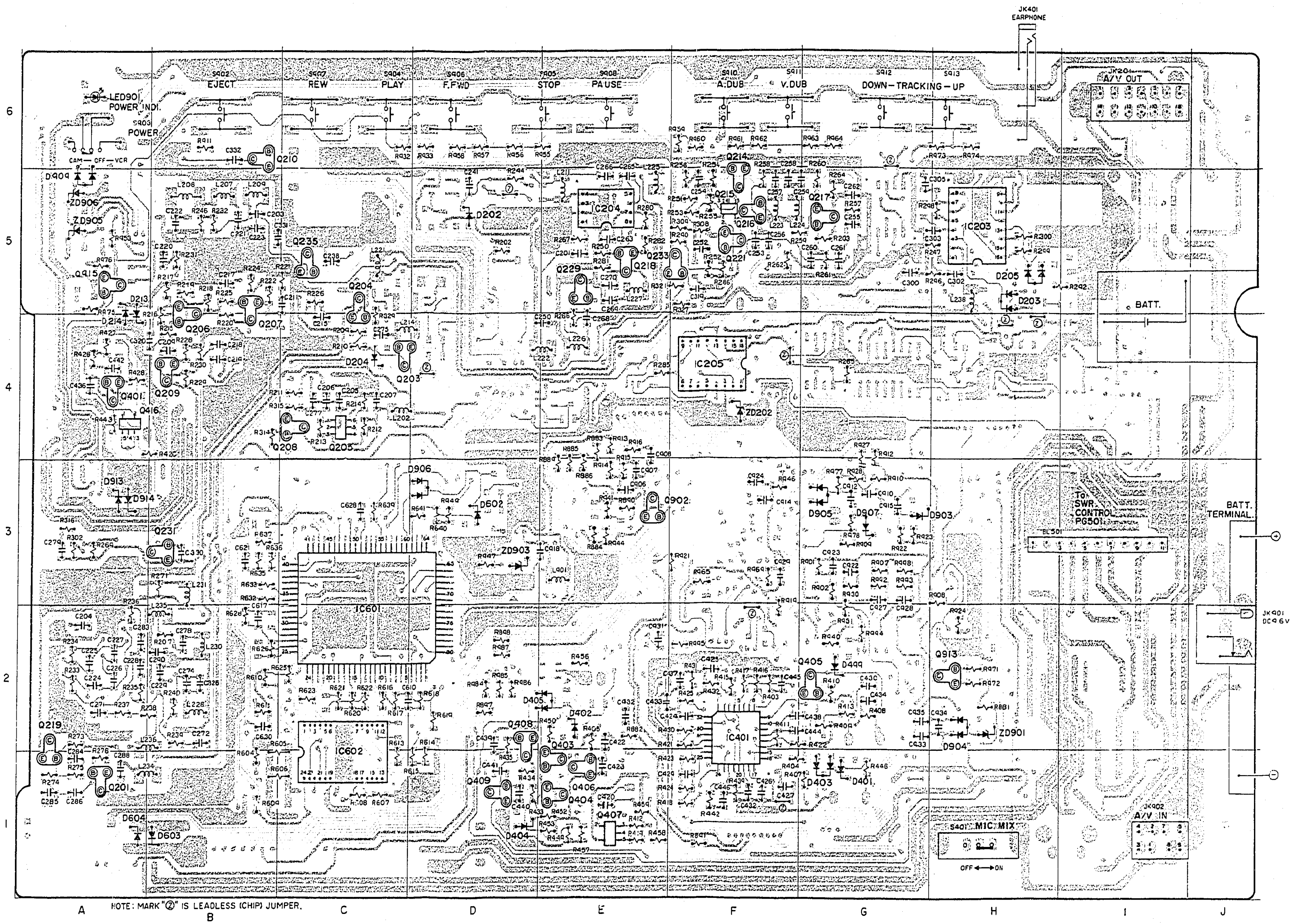


A
B
C
D
E
F
G
H
I
J
1
2
3
4
5
6
Q912
To EVF PG802
To DC LIGHT CN906
To CAMERA SW
To REC PAUSE CN907
To MIC UNIT CN481M
To PROCESS PG102
REC. LUMA. LEVEL
REC. CHROMA LEVEL
IC201
CP205
CP206
1H DELAY LINE OUTPUT LEVEL
DL201
Q234
Q222
Q223
D206
ZD202
Q226
Q225
D902
D908
D212
D211
F402
TP203
CP204
IC 210
D901
F401
Q909
Q910
Q908
D407
CONNECTOR FOR ADJUSTMENT
To CYL MOTOR PG601
Q230
TP207
IC903
IC907
CP401
IC901
Q903
Q901
IC902
Q421
Q419
Q503
Q501
Q502
Q508
D502
D501
To VIDEO HEAD CN201
IC202
PG SHIFTER
CN404
IC906
Q506
Q505
Q507
Q504
D606
D605
Q220
Q418
Q410
TP401
TP402
To CAPSTAN MOTOR DRIVE CNIM
To MECHA STATE SW
To FULL ERASE HEAD CN403
To AUDIO HEAD CN402
AUDIO BIAS LEVEL
To TAKE-UP SENSOR PG903
To LOADING MOTOR

NOTE : MARK "Ⓩ" IS LEADLESS (CHIP) JUMPER.

MAIN P.C.B (COMPONENT SIDE)

MAIN CIRCUIT BOARD DIAGRAM (SOLDER SIDE) -VM-4400A/4450A-


JK401 EARPHONE
S402 EJECT
S407 REW
S404 PLAY
S406 F.FWD
S405 STOP
S408 PAUSE
S410 A.DUB
S411 V.DUB
S412 DOWN-TRACKING-UP
S413
JK201 A/V OUT
LED901 POWER INDI.
S403 POWER
CAM — OFF — VCR
IC204
IC203
IC205
IC601
IC602
IC401
BATT.
To: SWR. CONTROL PG501
BATT. TERMINAL
JK901 DC 9.6V
JK402 A/V IN
S401 MIC MIX
OFF ←→ ON
6
5
4
3
2
1
A
B
C
D
E
F
G
H
I
J

NOTE: MARK "②" IS LEADLESS (CHIP) JUMPER.

MAIN P.C.B (SOLDER SIDE)

PARTS LIST

SYMBOL-NO	P-NO	DESCRIPTION
		VTR SECTION
C330	0893031	CERAMIC CHIP 1000PF+-10% 50V
C452	0806024	ELECTROLYTIC 3.3μF 6.3V
R422	0103867	CHIP RESISTOR 100KOHM+-5% 0.1W
R458	0103843	CHIP RESISTOR 1KOHM+-5% 0.1W
R459	0103851	CHIP RESISTOR 4.7KOHM+-5% 0.1W
R460	0103855	CHIP RESISTOR 10KOHM+-5% 0.1W
R461	0103871	CHIP RESISTOR 220KOHM+-5% 0.1W
R641	0103855	CHIP RESISTOR 10KOHM+-5% 0.1W
R850	0700045	CARBON FILM 2.2KOHM+-5% 1/8W
R945	0103867	CHIP RESISTOR 100KOHM+-5% 0.1W
D211	5328321	DIODE MA151K (MH)
D212	5328321	DIODE MA151K (MH)
D213	5328321	DIODE MA151K (MH)
D214	5328321	DIODE MA151K (MH)
D405	5328304	DIODE MA152WA (MO)
D407	5328321	DIODE MA151K (MH)
D499	5328321	DIODE MA151K (MH)
D909	5328304	DIODE MA152WA (MO)
IC901	1355239	IC HD4074719H 7.5C
IC901	1356081	IC HD404439A38H
Q203	5328796	TRANSISTOR XDC144EK
Q206	5328971	TRANSISTOR 2SC2412KBRST
Q207	5328971	TRANSISTOR 2SC2412KBRST
Q208	5328971	TRANSISTOR 2SC2412KBRST
Q209	5328971	TRANSISTOR 2SC2412KBRST
Q216	5328971	TRANSISTOR 2SC2412KBRST
Q217	5328971	TRANSISTOR 2SC2412KBRST
Q221	5328971	TRANSISTOR 2SC2412KBRST
Q230	5328971	TRANSISTOR 2SC2412KBRST
Q231	5326254	TRANSISTOR DTC143TK
Q405	5328971	TRANSISTOR 2SC2412KBRST
Q418	5328721	TRANSISTOR 2SD1328
Q419	5328797	TRANSISTOR XDA144EK
Q421	1323421	TRANSISTOR KSC1623G (0)
Q421	5328971	TRANSISTOR 2SC2412KBRST
Q507	5328971	TRANSISTOR 2SC2412KBRST
Q508	5328971	TRANSISTOR 2SC2412KBRST
Q903	5328971	TRANSISTOR 2SC2412KBRST
Q913	5328971	TRANSISTOR 2SC2412KBRST
Q915	5328971	TRANSISTOR 2SC2412KBRST

VM-4400A(U,C)/VM-4450AW,A(PX)/VM-5400A(U,C)

HITACHI

VM-4400A(U,C)/VM-4450AW,A(PX)/VM-5400A(U,C)

VM-4400A(U,C)
VM-4450AW,A(PX)
VM-5400A(U,C)

TK No.3656E TOKAI Consumer Electronics Division

Copyright © Hitachi, Ltd. 1992. All rights reserved.

Printed in Japan (K)